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(MN LOE II)

Final Report

June 2003

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14. ABSTRACT
This process-refinement experiment examined how to build a multinational operational net assessment (ONA) using a distributed, collaborative information environment (CIE), as well as information release issues among coalition partners. Additionally, it assessed the viability of the multinational information sharing for the allies and coalition partners (MNISACP) concept of operations.

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MULTINATIONAL LIMITED OBJECTIVE EXPERIMENT II (MN LOE II) FINAL REPORT

June 2003

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EXECUTIVE SUMMARY

Multinational Limited Objective Experiment (MN LOE) II was the second event in a series of four multinational experiments. This process-refinement experiment examined how to build a multinational operational net assessment (ONA) using a distributed, collaborative information environment (CIE), as well as information release issues among coalition partners. Additionally, it assessed the viability of the multinational information sharing for the allies and coalition partners (MNISACP) concept of operations developed by the USJFCOM J6.[1] MN LOE I, conducted in November 2001, examined how a combined joint force headquarters might plan to conduct rapid, decisive operations in a distributed, collaborative information environment with coalition partners. The remaining two experiments will build upon the lessons learned from MN LOE I and II and will address combined planning and execution. This series of experiments contributes to USJFCOM's transformation strategy by feeding its concept development and prototyping paths. An overarching objective of the multinational experiment series is to include multinational partners in Joint Futures Lab and Distributed Continuous Experimentation Environment events that promote multinational agency participation.

Results of multinational experimentation will support further development of a standing joint force headquarters and will provide data for information sharing, multilevel security, and collaborative ONA development to both the NATO Concept Development and Experimentation (CDE) Working Group and to the Multinational Interoperability Council (MIC) Working Group. The results also will provide evidence that addresses the task assigned by the Chairman, Joint Chiefs of Staff, to develop a MNIS operational concept and associated architecture.

The participants of MN LOE II—Australia, Canada, Germany, the United Kingdom, and the United States—are members of the MIC, which, along with France, unanimously designated the experiment as a Level 2 CDE event[2]. NATO CDE/Supreme Allied Commander Atlantic (SACLANT) played the role of a separate nation. France, the sixth MIC member nation, actively observed the experiment in an effort to learn the CDE process and to prepare for participation in MN Experiment III. The experiment was conducted in a distributed environment. The U.S. planning cells were located within J9 Joint Experimentation in Suffolk, Virginia, and the Australian, UK, German, and Canadian cells were located in Fern Hill Park, Portsdown West, Ottobrunn, and Ottawa, respectively. The Combined Federated Battle Laboratory (CFBL), a dedicated wide-area network for experimentation, provided connectivity for the MN LOE. Participating

[1] See Appendix J for an overview of the ONA and MNIS concepts.

[2] In a Level 2 CDE event MIC member nations participate as guests in other members' CDE initiatives. A lead nation provides the CDE infrastructure and secretarial support that "host" supporting member nations, who meet their own in-country costs and who help to shape the event, at the request of the lead nation.

nations took an active role in the design and execution of the experiment. Three scheduled and two ad hoc workshops introduced the U.S. ONA process prior to MN LOE II execution in Suffolk, Va.

The MN LOE II used a pre-crisis scenario, set in a peaceful area in 2010. Amid an ongoing regional military and political dialogue, the regional combatant commander decided to watch closely the activities of two countries in the area. Potential coalition partners were consulted, and led by the United States, five countries agreed to develop an MN ONA based on national ONAs. National headquarters began collaboration with the regional combatant commander's standing joint force headquarters to develop an MN ONA.

Experiment Objective 1 was to identify and assess the ability of national headquarters to develop a distributed multinational ONA database. The MN LOE II demonstrated that a multinational coalition could successfully conduct the U.S. ONA process in a distributed environment. While the ONA process was not fully exercised, all participants found the U.S. approach of system-of-systems analysis of the adversary, ourselves, and the operational environment to be powerful. While the tools require continued development, and while disclosure policies may hamper achievement of a full multinational capability, all participants support aggressive pursuit of a multinational ONA.

Experiment Objective 2 was to identify and assess collaboration and information sharing across different security domains. This construct was subject to the current too-general and too-encompassing information-sharing rules that constrain the ability to share information in pre-crisis situations. Such restrictions are detrimental to building trust within the coalition and to developing a collective understanding. To mitigate the fear and perceived risk behind current information-sharing rules, the potential benefits of collaboration require a real change in policy.

MN LOE II demonstrated the first coalition attempt to build an ONA in a distributed environment. The experiment also examined the MNIS operational concept of information sharing across security domains. Finally, MN LOE II served as a venue for exploring topics of national interest. The feedback from all participants provided many valuable recommendations that ultimately will benefit future LOEs and other related projects. Experiment analysts from all nations independently evaluated the experiment data and presented corroborating results at the post-event workshop.

Many lessons learned and recommendations resulted from MN LOE II. See Section V for detailed discussions of experimentation lessons learned.

Eight key lessons learned may enhance future experimentation:

1. Succinct definitions are needed for all experiment objectives and issues.
2. Experiment analysts and concept writers from all the participating nations must be directly involved in the experiment planning and design from the early stages of the experiment development.

3. Any changes to the experiment design during experiment execution must continue to be coordinated with experiment analysts and partner nations to ensure conditions that produce valid and reliable findings.
4. Time management issues must be considered during experiment planning to ensure sufficient time is allotted to study all critical concepts under investigation. Furthermore, earlier stabilization of the player list will preclude many of the time constraint issues.
5. Training should provide in-depth knowledge of essential concepts so that participants may use tools and may transfer knowledge among themselves during the experiment. A practice walk-through is essential to give players the "big picture" and to teach a series of unified tasks rather than disconnected steps.
6. A robust collaboration concept of operations or tactics, techniques, and procedures is needed. Future experiment events will require more thought and consideration of collaboration.
7. Experiment planning sessions should be designed around the use of a collaborative tool or teleconference to allow for all multinational experiment leads to be more directly involved with the planning process. All key U.S. participants or their representatives should be required to attend IPT meetings.
8. Robust experimentation with MN partners will require a boost in network bandwidth. Actions must be initiated now to boost bandwidth availability.

A select group of former general and flag officers, known as senior concept developers (SCDs), participated in a variety of activities as a source of experience and knowledge that contributes to the growing understanding of the concepts examined in the experiment. The group's three key recommendations were deemed essential to the development of the concepts:

1. SCDs urged the use of a real-world scenario for the next multinational experiment (MNE), scheduled for February 2004. They unanimously and emphatically endorsed the importance and value of this recommendation, which also offers:
   - The addition of significant granularity to the ONA database
   - Greater stress placed on the ONA process and MNIS hypothesis
   - Increased political support and multinational interagency participation
   - The development of real-world nodes, links, actions, and resources, as well as the generation of an effects plan that may be used for both experimentation and ongoing stability operations.

2. The SCDs recommended that the commander, USJFCOM, should advise the Department of Defense (DoD) to review its information-sharing policy, practices, and procedures, which do not reflect the demanding requirements of the information age. While every nation would have a foreign disclosure

policy regarding highly classified information, these DoD directives should be revised to emphasize the idea of "withholding information by exception" in a coalition environment.

3. The SCDs recommended the development of a knowledge white paper that would generate further study, debate, and exploration of this critical aspect of future joint and combined operations. Although current joint force concepts emphasize the value of and necessity for knowledge, a distinct "knowledge concept" does not exist. A knowledge white paper should define *knowledge* and should address the supporting elements of knowledge superiority, management, readiness, and warfare.

Although any experiment offers the potential to examine many issues, all of the partner nations of the MN LOE II agreed upon the critical operational issues (COIs) necessary to explore the main experiment objectives. This table depicts the findings of the experiment, grouped under their related COIs.

THE FINDINGS

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I. EXPERIMENT OVERVIEW

A. INTRODUCTION/PURPOSE

Multinational Limited Objective Experiment (MN LOE) II is the second experiment in a series of four. MN LOE I, conducted in November 2001, examined the way a combined joint force headquarters might plan to conduct rapid, decisive operations (RDO) within a distributed, collaborative information environment (CIE) with coalition partners. The remaining two experiments will build upon the lessons from MN LOE I and II and specifically will address knowledge-building, command and control (C2), and operations in each subsequent event. In addition, this series of experiments will feed the concept development and prototyping paths, contributing to USJFCOM's transformation strategy. (See Figure 1.)

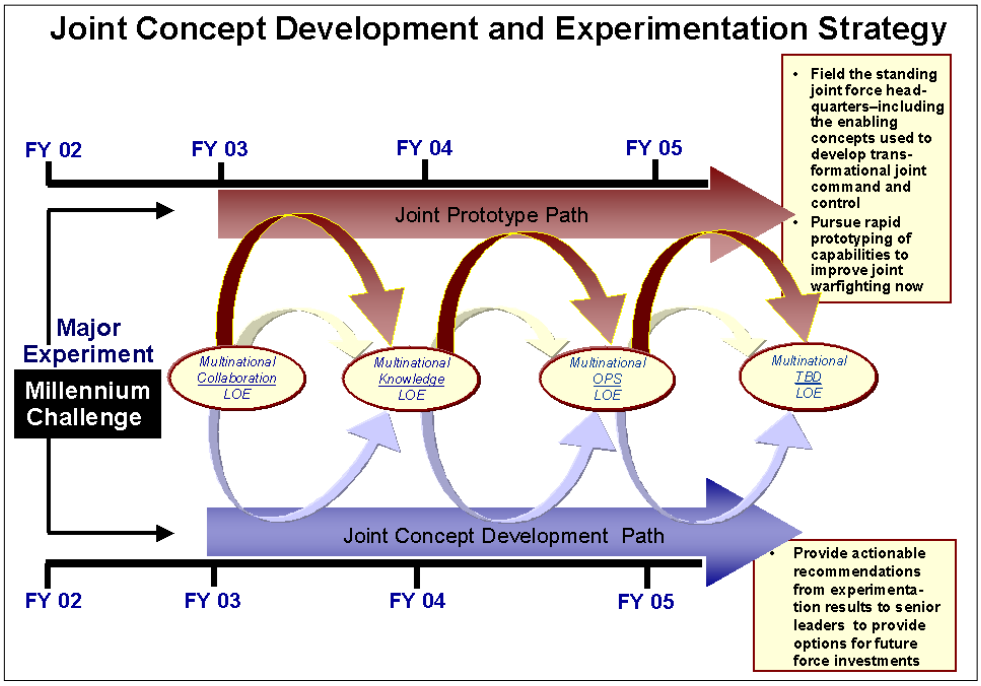

Figure 1. Two-Path Architecture

The goal of MN LOE II, a process-refinement experiment conducted February 10-28, 2003, was to examine how to build a multinational operational net assessment (ONA) using a distributed, collaborative information environment. The experiment also focused on information release issues among multinational partners.

Additionally, it assessed the viability of the multinational information sharing for allies and coalition partners (MNISACP) concept of operations developed by the USJFCOM J6. All the participants of MN LOE II—Australia, Canada, Germany, the United Kingdom, and the United States— are members of the MIC, which, along with

France, unanimously designated it as a Level 2 CDE event, led by the U.S. NATO CDE/SACLANT played the role of a separate nation. France, the sixth MIC member nation, actively observed the experiment in an effort to learn the CDE process and to prepare for participation in MN Experiment III. USJFCOM led the combined effort from the U.S. Joint Experimentation site (J9), Lakeview Parkway, Suffolk. The remaining players, with the exception of SACLANT, participated from their national experimental facilities. A memorandum of understanding (MOU) between Australia and SACLANT covered their participation in the experiment.

Participating nations helped to design and execute the experiment. The United States ONA process was introduced through three workshops prior to MN LOE II execution:

1. September 2002: One-day overview of ONA political, military, economic, social, infrastructure, and information (PMESII).

2. November 2002: Two-day effort to establish knowledge baseline, including the blue force view of the red force, the blue force view of itself, the red force view of the blue force, the red force view of itself, system-of-systems analysis, and node development.

3. January 2003 workshop: Conducted over Combined Federated Battle Lab (CFBL) net for LOE participants on process refinement and tools training.

Section 1 describes the purpose, scope, and objectives of MN LOE II. Section 2 provides an overview of the experiment design. MN LOE II analysis strategy, ONA preparation and usage, technical command, control, communications, computer, and information (C4I) aspects, and the information-sharing construct are detailed in Section 3. Section 4 contains the findings. A summary of experimentation lessons learned and recommendations and the subsequent analysis phase are provided in Section 5. The report conclusion is detailed in Section 6.

B. SCOPE

This experiment aimed to identify and assess issues associated with conducting an ONA in a collaborative environment, as well as issues regarding information sharing across different security domains within a coalition environment. The experiment results will:

- Feed efforts to develop national standing joint force headquarters
- Inform multinational concept development and experimentation efforts, as well as those of the working groups of the Multinational Interoperability Council
- Help to assess and refine the coalition information-sharing operational concept and architecture.

MN LOE II goals included:

- To identify issues regarding the ability of national headquarters staffs to conduct distributed ONAs
- To refine MNIS operational concept and architecture

- To refine goals, objectives, and the "way-ahead" for Olympic Vision '03, Olympic Challenge '04, and other transformation events.

C. MN LOE II OBJECTIVES & CRITICAL OPERATIONAL ISSUES

> *"Request you determine what information should be shared, in addition to how, when, and with whom, and also provide comprehensive recommendations on a definition of and the policy for operational requirements."*
>
> —From Gen. Richard B. Myers' letter
> to Gen. William F. Kernan
> (Recommendations sent to the Chairman,
> Joint Chiefs of Staff, April 15, 2002)

The two objectives of this experiment stemmed from guidance on multinational information sharing in a letter from the Chairman, Joint Chiefs of Staff, to the commander of Joint Forces Command[3]. All participating nations agreed upon objectives and critical operational issues (COIs).

Objective 1: Identify and assess issues associated with the ability of national headquarters staffs to conduct a distributed ONA.

Hypothesis: *If* partner nations conduct ONA through distributed collaboration, *then* a better ONA will be achieved.

Critical Operational Issues: Is the ONA process viable in a coalition environment? What are the impacts of cultural and/or organizational differences on coalition collaboration?

Objective 2: Identify and assess issues associated with collaboration and information sharing across different security domains.

Hypothesis: *If* a future multinational information-sharing concept is employed to conduct collaboration and information sharing across different security domains, *then* shared situational awareness will be improved.

Critical Operational Issues: Does collaboration with coalition partners across security domains improve the ONA? What impact does information sharing have on each phase of the ONA process? Does the MNIS future concept speed up the ONA process? Can information release procedures keep the ONA data current?

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[3] References: (a) Chairman, Joint Chiefs of Staff letter, guidance on multinational information sharing, dated January 25, 2002. (b) Commander, Joint Forces Command memorandum, response to Reference (a).

D. PARTICIPANTS/LOCATIONS

Some 58 participants played from dispersed locations:

- United States 7 planners/11 system-of-systems analysts[4]
- Regional (NATO) 3/6
- Australia 1/4
- Canada 3/4
- Germany 5/7
- United Kingdom 2/8.

One hundred and two people, including seven senior concept developers (SCDs)[5], supported the experiment. See Appendix G for a detailed account of experiment demographics.

- United States 55 [4 national liaison officers (LNOs)]
- Regional (NATO) 2
- Australia 13
- Canada 10
- Germany 10
- United Kingdom 12.

The CFBL, a dedicated wide-area network, provided connectivity for the MN LOE. Three central points—the United States players, the control cell, and NATO—were located at USJFCOM in Suffolk, Va. The national headquarters locations included:

- DSTO, Fern Hill Park, Canberra, Australia
- Canadian Forces Experimentation Centre, Ottawa, Canada
- Center for Analyses and Studies, Operations Research Division, Ottobrunn, Germany
- DSTL Portsdown West Facility, Fareham Hampshire, United Kingdom.

These organizations provided observers and survey materials for experiment analysis:

- Defence Science & Technology Organization (DSTO), Fern Hill Park, Australia
- Defence Science & Technology Organization (DSTO), Edinburgh, Adelaide, South Australia
- Canadian Forces Experimentation Centre (CFEC), Ottawa, Canada
- Center for Analyses and Studies, Operations Research Division, Ottobrunn, Germany
- Defence Science & Technology Laboratory (DSTL), Portsdown West, UK
- U.S. Army Research Laboratory
- NATO SACLANT Headquarters
- SPAWAR Combatant Command Interoperability Program Office.

[4] See Appendix J for an overview of system-of-systems analysis.

[5] Senior concept developers are a select group of former general and flag officers contracted to participate in a variety of activities as a source of experience and knowledge that contributes to the growing understanding of the concepts examined in the experiment.

II. EXPERIMENT DESIGN

A. SCENARIO & VIGNETTES

The MN LOE II scenario and its four vignettes were derived from the scenario developed for the Pinnacle Impact 2003 and Joint Global Wargame 2004 experiments. (See Appendix B.) They provided a focused look at selected aspects of a developing situation in the Pacific Rim. This construct helped to develop a multinational ONA that was much narrower in scope than that of a full coalition ONA. All vignettes stood alone; one did not grow from another, and the information gleaned from one did not affect subsequent vignette execution.

1. Injects

Twenty-three products, or injects, were created for each vignette—four each for Canada, the United Kingdom, Germany, Australia, and the United States, and three for the regional nation (NATO SACLANT Headquarters). USJFCOM J9 experiment controllers developed 92 injects to support the four vignettes from unclassified sources that represented national intelligence products, diplomatic and law enforcement communiqués, military message traffic, and verified open-source media. Each product was marked with an experiment classification and an initial release caveat, as delineated by the MNIS matrix (Figure 2). All products were created to stimulate and guide multinational ONA development and MNIS processes, given the limited time available for the participants to assimilate and enter the data during each vignette.

2. Information-Sharing Matrix

The MNIS matrix (Table 1) comprised six domains: multilateral, trilateral, bilateral 1, bilateral 2, coalition, and private. Each represented differing relationships among the participating countries. Injects were developed for each country in a specific domain to stimulate the participants to delete, add, or modify an effect, node, action, or resource (ENAR) record in the ONA database. Depending on the product, the action would be accomplished by the multinational ONA system-of-systems analyst, who would update the nodes in the ONA database, or by the planners, who would update the effects, actions, or resource listings in tandem with the analysts. For more information about the MNIS concept/process, see Sections II E and III E.

Country	ML	TL	BL_1	BL_2	Coalition	Private	Total
AUS		E		N	R	A	4
GER	E	N			A	R	4
CAN	R	A			E	N	4
UK	A		E		N	R	4
US	N		A		R	E	4
RP				R	A	N	3

Table 1. MN LOE II MNIS Matrix

B. ANALYSIS

Developed as part of the design process, an experiment analysis plan covered:

- Experiment design and COIs
- Collection of quantitative and qualitative data to support assessment of the experiment COIs
- Data collection methods
- Assessment strategy
- Analysis methods.

Participating nations played an active role in the design and execution of the experiment analysis plan. As a result, they helped to identify national objectives, issues, metrics, and associated data collection requirements.

The experiment analysis plan included the four data collection methods used:

- Analyst participation as control cell members
- SCD interactions and discussions
- Players' questionnaires
- Observations.

For information about the data collection and assessment methodology, see Section III.

C. MN LOE II ARCHITECTURE

MN LOE II consisted of three, five-day periods during which the participants focused on different aspects of the multinational ONA and deliberate planning process. Week 0 (February 10-14, 2003) was devoted mainly to tools refresher (Groove, ONA graphical layout) and process training for all participants. Weeks 1 and 2 were used to examine the building of the ONA. Week 1 (February 17-21) examined the "as is" MNIS

environment during pre-coalition multinational ONA development, while Week 2 (February 24-28) considered the future MNIS environment.

1. Distributed Collaboration Instrument

MN LOE II used a commercially available software package known as "Groove" that enables distributed collaboration. This technology was used during the preplanning phase to allow collaboration during scenario development and in preparation for experiment analysis. Groove included several workspaces, a graphical layout (GL) tool that allows the user to visually access the linked portions of the ONA database, text chat in all spaces, audio communications, and private e-mail chat capability.

2. Pre-execution

The months preceding the experiment included several planning meetings, workshops, development, and refinement of the vignettes and injects. Early in the process, the multinational partners agreed on the four basic vignette focus areas and discussed various aspects of the MNIS process. Later, during the course of three ONA workshops, the participants refined various aspects of the ONA and effects, actions, and resource listings. In three ONA workshops, the U.S. ONA process served as a model. A compact disc (CD) containing the scenario and vignette information, injects, concept papers, briefings, and the experiment overview briefing was distributed to the J9 "trusted agents" who deployed to the participating countries during the execution phase. Each of these trusted agents would extract his country's injects and post them into the respective "private" country domain within the Groove shared space. Because of the lead time needed to create the injects and to produce and distribute the CD, the J9 experiment controllers provided early lists of proposed effects, actions, and resources for use during the inject development phase, rather than the final lists from the third workshop.

3. Week 0

The first week reinforced the basic concepts of effects-based operations (EBO), ONA, and MNIS, while simultaneously providing additional tools refresher training to all experiment participants. Reinforcement of the U.S. ONA process began with reviews of the effects, actions, and resources products that were developed during the three workshops and then rolled into a controlled walk-through of the entire process, using the collaborative tools.

4. Weeks 1 & 2

Experiment play started with a short scenario briefing and an introduction of the vignette to participants. Both were posted in Groove for their review, along with supporting documents. Vignette descriptions remained posted after their completion. While the vignettes were not linked, the same data originally planted within the ONA database was used for each of them.

Each country's trusted agent extracted the four injects for each country, as well as three for the regional player, from the MN LOE II CD and posted them in that country's private Groove shared space for review and action, i.e., withholding the product completely or posting it to other shared spaces, in a sanitized form or in its entirety. If further dissemination of the information was deemed necessary, the product would be reviewed through the originator's disclosure process, and if approved, posted in other shared spaces on Groove with an updated classification release caveat. Upon receipt of the new product, the plans and system-of-systems analysis teams would use the Groove collaborative tool to work through the effects, actions, and resources process. This process was repeated for each vignette.

D. VIGNETTE SCHEDULE

Each of four vignettes focused on a different aspect of the developing regional situation, while stressing multinational ONA development and MNIS. The participants examined each vignette during a two-day period, executing two vignettes per week. The remaining day included after-action reviews and national "hot wash" discussions. During Week 1, the first two vignettes concentrated on two focus countries with separate and limited connections whose militaries operated independently of each other. During Week 2, the third and fourth vignettes used the premise that both focus countries may federate and that, therefore, the multinational ONA and planning process should examine the effect of a combined regional power rather than of two independent ones.

E. INFORMATION SHARING

Discussion about the execution of the information-sharing portion of MN LOE II demands review of the experiment design used to examine the U.S. MNIS operational concept (OPCON). The MNIS OPCON defines a future vision where information is protected at its source and is shared with coalition partners across a single information sharing environment. In addition, all coalition partners would not have access to all information, and classification may be used to control access. This vision applied to a wide range of activities, from prehostilities through postcombat planning and execution. Access was based on controls enforced at information destinations.

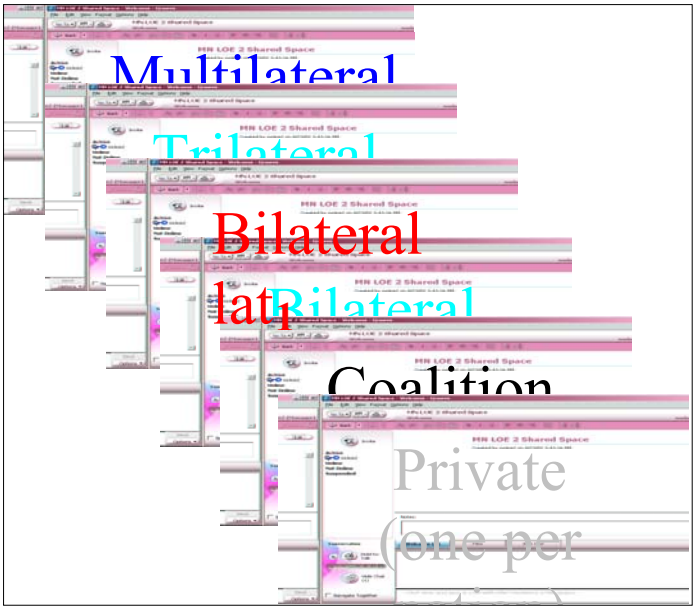

Figure 2. Current Information-Sharing Design

Is the future information-sharing vision better than the current system? Current information sharing includes multiple security domains, each supporting bi-, tri-, and multilateral sharing agreements. (See Figure 2.) To release information outside the sharing agreement, the information originator followed national disclosure procedures. If the information was developed collaboratively, all parties first must agree to further disclosure before the disclosure process started.

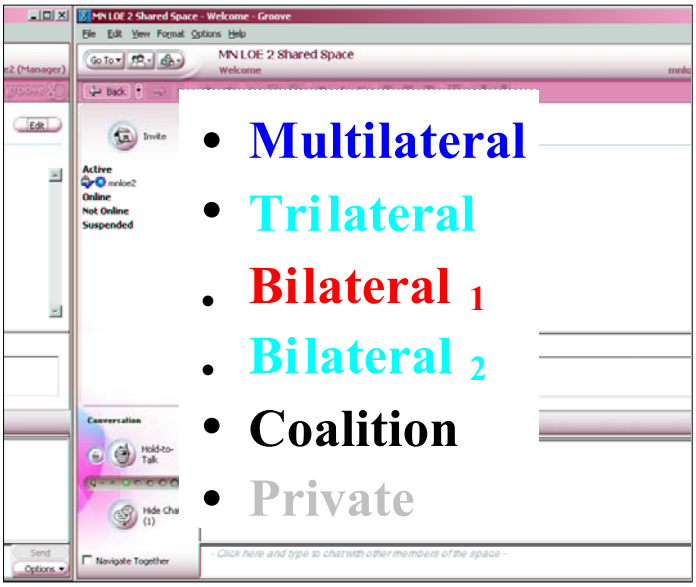

Figure 3. Future Information-Sharing Design

Originally, future information sharing was seen as a single security domain where all information would be released. Rather than retrieving information from separate security domains, participants would view all information released to them in the coalition security domain. (See Figure 3.) A participant's nationality and his nation's participation in the relevant information-sharing agreement would determine access. However, national, bi-, tri-, and multilateral domains remained within the single security domain, and national information was not placed within the coalition security domain.

For both current and future information-sharing treatments, Groove shared spaces were used in conjunction with the ONA database security features to establish security domains. The LOE technical team invited participants to join a shared space and controlled access to shared spaces. All participants had access to the coalition-shared space, spaces representing the multinational and bilateral agreements, and to their respective national shared space.

The technical team also set up the ONA database with fields for disclosure to sharing agreements for each node. Reference files linked to a node also had accompanying disclosure tags. When the current information-sharing treatment was in effect, participants used their Groove identities to enter the shared space to view ONA database node records for that sharing agreement. Participants could view and retain information not released by their nation by saving information within their national shared space. Since only node information was tagged, participants could not go to a single shared space to view all information released to their nation. According to the experiment plan, when the future information-sharing treatment was in effect, participants could view all information released to their nation in the coalition shared space, including their respective national information not released to others.

The assumption *a priori* was that the null hypothesis—no difference exists between the information-sharing treatments—would be rejected. Shared awareness should increase when all information that is released to participants is available in a collaborative shared space.

Measuring shared awareness during the information-sharing treatments began as the control team distributed disclosures to participants at the beginning of each vignette. Each treatment was exercised during two sequential 16-hour vignettes performed in eight-hour segments. Participants answered "probe" questions periodically, and the responses were used to establish situational awareness. At the end of each experiment segment, participants also completed questionnaires and provided comments about the information-sharing treatments.

The LOE exercised the Coalition Information-Sharing Policy and Procedures Panel (CISP3) as an adjunct. The CISP3 concept evolved from the Command-and-Control Interoperability Board (CCIB) used in the U.S. Pacific Command. The capability to coordinate common requirements for sharing information was likened to the CCIB process to establish interoperability to the greatest extent possible. As the MNIS OPCON developed, the CISP3 concept emerged as a capability that could enhance efficiency for the coalition as a cohesive force from the start. The panel would establish a common set of information-sharing policies and procedures to support the coalition commander's intent, bringing with it national limitations and sensitivities.

The CISP3 establishes and maintains policy and procedures that permit the creation of coalition information-sharing environments. The LOE could not examine all aspects of the panel. In accordance with the experiment design, a CISP3 member from each nation helped to develop information exchange requirements (IERs), which are needed to build a coalition knowledge base. Most participants agreed that the IERs were too cumbersome and that the role and functions of the CISP3 were poorly defined. To accelerate information release during Week 2, the CISP3 identified categories of releasable information without following national disclosure procedures. Each national panel developed a list based on Annex B of the MNIS OPCON document. Analysts and planners then used the lists to determine the information to be released without going through formal disclosure processes.

III. EXPERIMENT EXECUTION

Daily experiment execution was governed by the schedule presented at the beginning of each day by the chief controller. Constructed as part of the experiment design, this schedule was fine-tuned for the upcoming day using observations and suggestions from: 1) senior concept developers, 2) chief controller's end-of-day hot wash with national lead controllers and MN LOE II functional leads, 3) the plans and system-of-systems analysis (SoSA) team leads, 4) the technical director, and 5) the experiment director. Each experiment day began with a Groove oral and text-chat national check-in with the chief controller. He reviewed the day's experiment objectives, the daily focus for collaboration, the status of the systems, issues to be resolved, and daily surveys to be completed. Plans and SoSA team leads then began the daily session. Each day started and ended on time.

A. EXPERIMENT WEEK 1 AND WEEK 2

Week 0, the final training session, focused mainly on using the collaborative tool, the database, various other tools, the ONA concept, and the experiment scenario. Week 1 introduced the experiment audience to the multinational ONA development process, in which the ONA process of knowledge discovery from the vignette injects was combined with the development of a multinational ONA. Week 2 broadened the systems-of-systems approach to include more effect, node, and action options leading to the development of a shared knowledge base.

1. Experiment Week 1

Vignette 1 presented the scenario framework of the focus nations' improved military capabilities. Plans and SoSA chose to work separately, and considerable time was spent redefining effects developed during Week 0 to match the scenario/vignette. They also identified applicable nodes. Experiment control monitored some analyst-to-analyst private chats, public text chat, and intermittent Groove audio to observe player actions. Vignette 1 promoted an understanding of the relationship of new information to a framework of predetermined effects. Vignette 2 combined player understanding of applicable nodes with the refined effects within a scenario that now included political and economic considerations. The throughput of vignette information improved as analyst-to-analyst confidence developed. Communications anomalies in the Groove system, especially in the audio, necessitated more "national only" node and effect development, resulting in some redundancy among nations. This imposed an unrealistic constraint upon the numbers of effects and nodes to be addressed by the experiment audience. Vignette 2 promoted a dialogue that presented national perspectives; differing interpretations of effects, actions, and resources in the context of the scenario; and a greater willingness to collaborate in functional areas.

2. Experiment Week 2

In Vignette 3, continued refinement of the multinational ONA process defined in Week 1 combined the improved effects with selected nodes, and then applied potential actions and resources within the scenario framework. The control cell monitored and orchestrated game progress through the network of trusted agents, since most work was conducted in private chat or face-to-face. Vignette information moved more quickly to a broader audience as the players recognized that the information affected multiple nodes and effects, thus requiring different actions.

At the request of the U.S. SoSA lead, the chief controller introduced a daily plan that kept the players on track through the combined interactive deliberations. Control monitored activity through text chat, private chat, Groove audio, and audio speakerphones. SoSA role players stimulated discussion. Vignette 3 emphasized that multinational ONA was not part of the intelligence process, separated some national players from a "pull mentality," and realized an SCD desire for introduction of national disagreements.

Vignette 4 capitalized upon the improved interactions, the daily schedule, and the player-developed ENAR spreadsheets from Vignette 3 within a framework of focus nations' political and military cohesion. Productivity increased as SoSAs were grouped by multinational PMESII disciplines and presented their nominations to the multinational plans/SoSA forum. Serving as a backdrop for functional refinement, Vignette 4 examined the DIME wargaming process for the first time since the LOE workshops. Introduction of DIME, as well as the visual presentation of ENAR linkages using the ONA graphical layout tool, stressed the complexity of multinational ONA development to the international players for the first time. Vignette 4 promoted the systems-of-systems approach, the need to introduce information rapidly into the intellectual analyst forum, and the acknowledgement of a changing environment within a seemingly hierarchically structured multinational ONA development process.

B. EXPERIMENT CONTROL

Because the experiment was distributed, MN LOE II control personnel in each of the participating countries communicated through the Groove collaborative tool and the telephone. Overall experiment control focused on a small cadre of individuals located in the J9 facility in Suffolk, Virginia. Each participating nation's lead controller conducted the experiment within that country. Liaison officers (LNOs) at the J9 facility and U.S. LNOs in each country provided a national cultural bridge. Although not part of the formal experiment control network, the LNOs provided an additional conduit and on-scene concept/experiment expertise. See Appendix C for a more information on the experiment control process.

1. LOE Management

The Groove tool was the primary means of collaboration among the participants and among control personnel. Three shared spaces within Groove were set aside for experiment control functions: control cell, white cell, and auditorium. Most of the

experiment audience participants could not view each space. Private chats and messages through the Groove system also allowed direct communication among all players for control and experiment participation. In addition, Internet Protocol phones were used to control private and conference call modes.

a) *Control Cell Shared Space*

This was the primary control cell communication avenue. Access was limited to national control cell leads, liaison officers, and functional leads.

b) *White Cell Shared Space*

Intended to provide a limited-access space that would allow discussions among national white cell personnel, this shared space was not used in any meaningful manner during the LOE.

c) *Auditorium Shared Space*

This shared space was intended to grant access to all participants and control personnel for mass training sessions (Week 0) and experiment-related briefings. In practice, when a significant number of participants entered the space, the audio became unintelligible. As a resolution, access to the auditorium shared space was deleted from most computers; only one per work area could enter this Groove space. This single computer was connected to a projector and external speakers, thus allowing a relatively large audience to view and hear the presentation. Despite this improvement, the poor quality of the audio using Groove had a detrimental impact upon the experiment.

d) *Private Text/Audio Chats and Messages*

The Groove system allowed the participants to conduct private text or audio chats among themselves. Additionally, private messages were widely used during the experiment by both participants and control personnel. These capabilities enabled the control cell to resolve individual concerns privately.

e) *Internet Protocol Phones*

The dial-up Internet Protocol phones were used to back up the auditorium's audio. Extreme problems with poor quality Groove audio could be circumvented using Internet Protocol phone conference calls with a visual presentation through the auditorium projection system or individual computers.

C. SYSTEM PERFORMANCE/TECHNICAL SUMMARY

All multinational technical support to MN LOE II was excellent, and Groove required much technical support to continue to run smoothly. With the exception of audio problems, the network, hardware, and software facilitated experiment execution. The ONA database provided excellent support for the event, but could be faster and more user

friendly. The ONA graphical layout and topographical map tools were not used often due to time constraints; their speed, flexibility, and user-friendliness also could be improved. System performance of the CFBLNet and of the J9 setup is detailed here.

1. Combined Federated Battle Laboratories Network (CFBLNet)

Collaborative planning for MN LOE II was conducted using the classified Combined Federated Battle Lab network (CFBLNet)[6], which allowed the MN LOE II to be conducted in a distributed global manner, with nations participating from facilities in their own country. Use of the CFBLNet and available national facilities netted considerable savings in travel costs. In addition, the network was available in all the nations to support the experiment, which facilitated the participation of national staff.

a) *Dynamic Environment*

Overall, CFBLNet management succeeded in resolving conflicts between MN LOE II and other experimental activities. Conducting activities on CFBLNet still proved challenging due to the sheer number of organizations with a stake in its maintenance. Two maintenance actions interfered with event execution: Australia effectively lost three days' participation during Week 0 due to an uncoordinated network upgrade, and another maintenance action was stopped before it affected the event. The most challenging part of using this network is communicating effectively with all of the key players in its operation. Participant nations must work closely and early with CFBLNet management and other agencies to ensure that all events and maintenance activities do not conflict with scheduled experiments.

b) *Network Monitoring*

Network monitoring and diagnostic tools, such as Qcheck, MRTG, and HP Openview, proved invaluable in tracking network anomalies and inefficiencies during the

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[6] The CFBL initiative is a consortium developed among the U.S., NATO, and nations involved with the Combined Communications-Electronics Board. "The CFBL net is a longer-term combined research, development, test, and evaluation network. It is not intended to be a combatant network or the architecture for a future network. This network is projected to remain in operation to conduct coalition C4I experiments and [to] provide possible parallel use in [combatant commander] coalition exercises. Creation of the CFBL net leverages joint warrior interoperability demonstration resources, existing U.S. federated battle laboratories assets, and coalition battle laboratories/test beds. As such, it will not be a solely U.S.-owned/operated network, but a combined network, with the members having equal say in its utilization and management. NATO nations participating in bilateral or multilateral CFBL net project arrangements are responsible for funding their portion of the effort, and there is no requirement for monies to be exchanged among participants. The NATO point of entry for [the] CFBL net is *NC3A The Hague*." [Joint Warrior Interoperability Demonstration 2002 Web site, http://www.jwid.js.mil/html/cfblnet.html.] CFBL net was chosen for MN LOE II because it is the only established and accredited wide-area network available for experimentation with multinational partners.

work-up spirals and execution. Seven such significant WAN anomalies were corrected, including three Domain Name Server errors in routers, two half-duplex/full-duplex setting mismatches, high latency routes, Open Shortest Path First routing anomalies, and more. Although CFBLNet personnel provided network monitoring support, local monitoring at participant sites proved to be invaluable, often helping to remediate network anomalies quickly. Future events on CFBLNet should continue to provide participant network monitoring, as well as to develop closer ties with the CFBLNet management.

c) *JFCOM Support*

JBC, J6, and J9 must collaborate to determine the JFCOM entity to support the CFBL net point of participation for future multinational events.

2. J9 MN LOE Network

a) *Account and Permissions Management*

Technical requirements for participant setup actions must be linked directly to the manning document. To avoid the need for technicians to update technical accounts and user permissions as the document changes, it could be integrated directly into the database, allowing automatic updates upon command.

b) *ONA Database*

Exposure of the ONA database to the multinational community led to these insights that may improve its future operation:

- The user interface should be faster to allow direct entry of data instead of using Excel or other tools for intermediate data capture.
- Improved user-friendliness of the interface would greatly enhance the productivity of the average user.
- To support real-world coalition operations, the database should be migrated to an integrated multidomain, multilevel, secure architecture that allows each user to see a fused picture of the ONA across all classifications and releasability levels to which they have access.

As part of this migration to a multidomain ONA, an Extensible Markup Language export feature should be added to facilitate data exchange between distributed coalition participant national databases. Each of these databases would be owned and operated by the respective participant nation, and they would control the release of information to other participants as directed by national information-sharing policies. The mechanism for releasing data would be policy-independent. Each nation would have the option to run a multidomain ONA database, and they would "plug and play" in a coalition environment. Each could replicate data to other coalition members, using the XML export feature.

c) *ONA Graphical Layout (ONA GL)*

The ONA graphical layout tool provides a visual interpretation of the relationships of data within the ONA database. Although available during MN LOE II, this tool was not essential, since the event primarily involved populating the ONA database; the tool will be more valuable during operational planning. After minimum exposure, feedback indicates that the tool must be more closely integrated with the Web application and mapping tools, including initiating database updates from this interface, and that it needs more flexible filtering options. In addition, the default view should be user selectable.

d) *ONA Node Topographic Map*

The ONA node topographic map tool similarly was not used much in this event. It provides a detailed visual perspective of the topographical relationships among nodes that will support operational planning. It will be more valuable in the next experiment in this series. Many of the same recommendations for ONA GL apply.

e) *Web Site*

No technical support Web site was available during MN LOE II to share configuration information, software, and software fixes/patches. Such a site may have alleviated some of the technical issues encountered, and it should be implemented for future events.

f) *Groove/Network Bandwidth*

Groove provides capabilities not currently available in any other software, and if managed correctly, it can be an enhancement to any collaboration suite. Groove was selected for this event because it provides encrypted voice and text chat, and since it is a P2P application, it does not rely on servers and is inherently more survivable. Each client maintains a copy of the information on its hard drive. However, Groove was used outside its capability to support this experiment. It is not designed for use in large collaboration environments; its capacity is about 20 participants. Specific difficulties encountered include:

(1) Audio Quality, Reliability, Scalability

The cause of audio problems cannot be attributed specifically to Groove or to the network bandwidth allocated. Groove audio quality was good in shared spaces of 10 members or less. It degraded gradually in shared spaces of 10–50 members and was totally unusable at 60 users in a shared space. Its effectiveness was nullified with as few as 15 users when significant bandwidth was consumed during other simultaneous network activities. During a network stress test, it cut out altogether. Due to the P2P nature of Groove communications, these numbers are not scalable with additional or upgraded equipment or network bandwidth. The baseline system employed Dual Athlon 1.5 GHz processors with 1Gb RAM on a 100Mbps fiber network. The minimum bandwidth available to distributed locations was 1.5 Mbps.

(2) Nature of P2P

The bandwidth-intense nature of P2P communications in a network this large mandated that the network be pristine. Groove's performance proved to be an indicator of overall network health. If a node's latency was high for any reason, performance degrades were immediately apparent. In MN LOE II, the CFBL net was not used for any other experimentation efforts and so was pristine. Within its design envelope, Groove operates in noisy, disconnected, and dynamic networks. Problems most likely occurred because the experiment tried to operate Groove outside of its design envelope.

(3) Groove Management Servers

For the purpose of the experiment, a Groove relay server was operated at the Australian site of DSTO Fern Hill Park in Canberra. This was integrated into the other Groove management servers maintained at J9. All other participants relied upon the U.S. J9 Groove management and relay server in a star topology. During part of the experiment, the U.S. LNO Groove client worked with the J9 relay server. When switched to the local relay server, synchronization, audio, and propagation of deltas—i.e., changes in the Groove spaces—improved. Thus, in any future experiment or deployment that uses Groove, the design of the Groove architecture and supporting management services should be considered.

(4) Fetch Loops

The condition known as "fetch loops" is an anomaly within Groove that substantially slows down the network performance. This phenomenon was encountered twice during execution and three times during testing. In the worst case, a distributed user placed ~4.5 Mb of files into a space shared by more than 100 users. This immediately stuffed the E1 service line for two to 12 hours, depending upon location and position in the P2P distribution queue. When Groove traffic stuffs a network "pipe," the transmission error rate increases considerably. Groove ensures that all information gets synchronized and sends a retrieval message when it detects dropped packets. These messages stack up into the already jammed pipe and generate more dropped packets, which generate more retrieval messages, and so on.

(5) Synchronized Not

On several occasions, user shared spaces indicated they were synchronized when, in fact, they were not, yet no error was reported. As a result, the user mistakenly believed that data was current. Upon discovery, the condition cleared after deleting the shared space from the offending machine and re-inviting the participant to the shared space. This condition is unacceptable. If synchronization is lost, faults must be reported reliably. The absence of fault reporting for this condition could have grave consequences in a military environment.

(6) Chattiness Among Servers

Groove's continual need to communicate between the management and database servers was generating so much "chatter" that eventually they were merged onto one Quad

server to improve system performance. The same should be done for any future events that use Groove in the database interface.

(7) Difficult To Run on a Closed Network

Groove Version 2.1 uses the World Wide Web to link back to Groove.net servers for updates. When set up in a closed network, it generated thousands of attempts to access the Web. This functionality had to be disabled and would make Groove difficult to accredit on operational systems without a thorough evaluation of the information that is continually being transferred via the umbilical to Groove.net.

(8) Accrual of Data in the Error Logs

Approximately 3Gb of data accumulated in the Groove relay error logs daily. The relay server was set to purge automatically after 10 days, but didn't. Attempts to initiate the purge using the **Purge** button failed, and therefore, files had to be manually deleted. The cause of this anomaly is undetermined; it may be related to Defense Information Systems Agency security lockdowns. Periodically, error logs must be deleted manually to prevent the Groove relay server from crashing.

(9) No Support for Roaming Profiles

To move users between machines is a manual process. Groove does not support roaming profiles. To compensate, Groove accounts should be exported/saved to a shared drive to support account recovery in the event of a PC failure.

(10) High-Maintenance Application

Peer-to-peer resynchronization times required technicians to start up workstations two to three hours before execution daily. This resulted in days that averaged 90 minutes longer than with similar client-server collaboration tools. Groove performed better when it communicated continuously. During MN LOE II, many systems had to be powered down to remove and store hard drives daily. This contributed to synchronization issues during system power up. When Groove detects changes, it does not immediately push the changes out to all the other potential users. Built within the application are algorithms that are invoked to balance the distribution of changes based upon knowledge of the network, bandwidth, availability of other clients, and relay servers.

D. ONA PREPARATION AND USAGE

Development of the ONA database was a shared responsibility of participants from all multinational partners. As the ONA concept proponent, the U.S. led this effort and trained and mentored other multinational participants throughout the development process. See Appendix E for a detailed listing of activities that occurred prior to MN LOE II

execution. In order to develop a common understanding of the ONA concept, the concept lead presented a briefing during the May 2002 concept development conference.

By the end of June 2002, a scenario had been selected for MN LOE II, and work began on a read-ahead package that would provide multinational participants with the understanding or foundation to develop a knowledge base for the scenario countries. By mid-July, a guide had been disseminated to participants that set forth the ONA process outlines for the six functional PMESII areas, as well as detailed questions about building a knowledge base across those categories. Additionally, the multinational participants received the latest ONA white paper and tactics, techniques, and procedure documents, which originated from Millennium Challenge 2002.

At the initial planning conference, the ONA concept brief again was presented to a larger body of MN LOE participants. At this time, a plan of action to build the ONA was also presented that set forth a building-block approach to develop the ONA knowledge base. The plan included a series of ONA workshops and homework assignments to be completed between planning conferences.

ONA Workshop 1 was conducted October 1–2, 2002, on site at the General Dynamics facility, Suffolk, Va. The workshop began with an azimuth check from the multinational participants on their progress in developing the knowledge base. Then participants received training on the system-of-systems analysis (SoSA), an analyst's presentation of a template for a completed PMESII summary, a database methodology, and the ONA process. To build upon the progress of Workshop 1, "homework" was assigned to participants to continue the knowledge building that had already begun, and specifically to complete their national PMESII summaries and to identify key nodes and critical vulnerabilities within those six PMESII categories.

Workshop 2 was held November 5–7, 2002, at the Renaissance Hotel, Portsmouth, Va., and at the Joint Futures Lab, Suffolk, Va. The workshop continued the education process begun in Workshop 1. Two days of classes and demonstrations discussed the ONA concept and provided illustrations of the SoSA and ONA process, a database familiarization, and a briefing on the combined multinational PMESII summaries. The afternoon of the second day included a seminar on "Blue-Red Views," as well as candidate node presentations. On the morning of the third day, a representative of the ClearForest commercial software company presented a demonstration of a data-mining tool called ClearResearch.

In the intervening period between ONA Workshops 2 and 3, ad hoc workshops were conducted to support newly designated multinational participants. A cell from SACLANT was introduced late in the planning to play the role of a regional nation during the LOE 2. Due to personnel tempo, several UK analysts were identified as participants late in the planning process. Two separate ONA workshops were added December 10–12, 2002, and January 7-8, 2003, to provide a foundation for the ONA process, the system-of-systems approach, PMESII summaries, database methodology, and tools training and demonstrations.

ONA Workshop 3 occurred January 15–16, 2003, using the Groove collaboration tool. For this event, multinational participants remained in their home nations, and the workshop was conducted in a collaborative information environment. This workshop focused on ONA process refinement, as well as on training for the ONA graphical layout tool, the ONA database, and the ONA geographic visualization tool. This was the last chance for ONA training until MN LOE II execution in Week 0.

The first five days of the LOE, Week 0, offered a review of the ONA and effects-based operations (EBO) concepts to the experiment audience as a whole. In addition, refresher training was provided for the Groove collaboration tool and the ONA database tools. SoSA business process rules were also explained in order to provide a common understanding of the mechanics of the ONA process. Finally, an illustrative linking of effects, nodes, actions, and resources (ENAR) was conducted, as well as a combined effort by all participants to review the database inputs to date and to reconcile the updates and changes. At the conclusion of Week 0, the ONA knowledge base was partially complete; a pool of effects, nodes, actions, resources, and some ENAR linkages was available. Figure 4 demonstrates the major emphasis within the ONA process during MN LOE II execution.

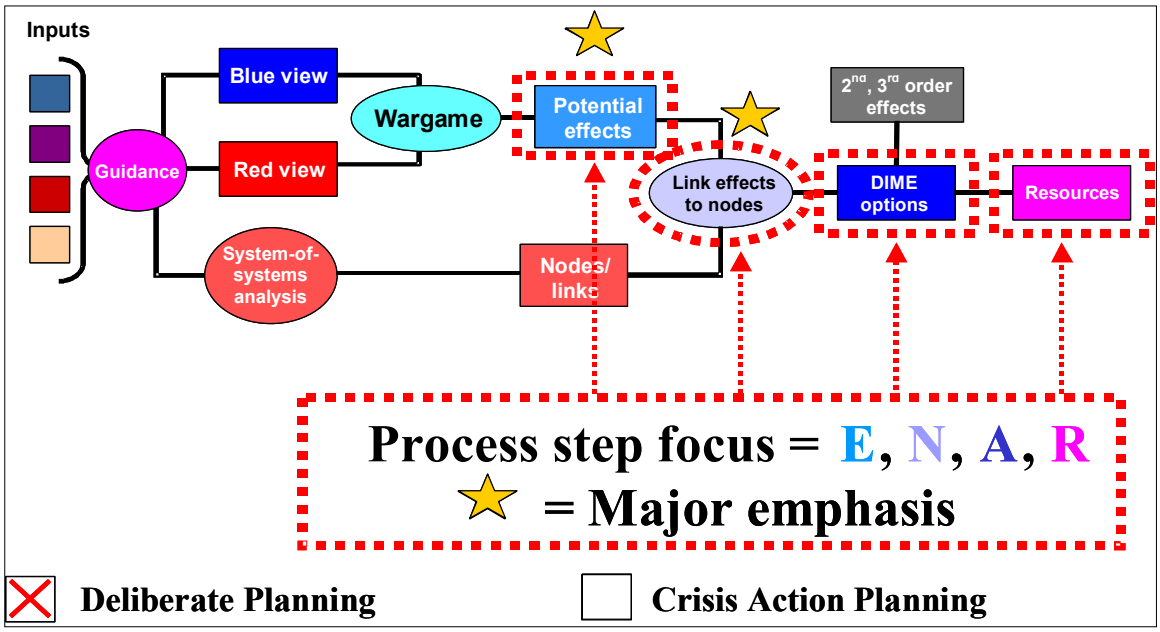

Figure 4. MN LOE II Execution ONA Process

E. INFORMATION SHARING

Analysis based on participant questionnaire responses and analyst observations indicates no significant difference between the two information-sharing treatments.

The ONA process was the main interest of the partner nations; they tended to view information sharing as more of a "U.S. problem." The ONA process was new and more

interesting to them, while information-sharing problems have been around forever. Thus, the U.S. placed more emphasis on presenting the ONA process in an "assembly" forum. The U.S. analysts and planners took the lead as participants and conducted the ONA process in much the same way as in Millennium Challenge 2002, a U.S.-only experiment where discussions occurred in a virtual assembly area. Releasing national information to the coalition was common in Week 1, and observers noted that some participants truncated national disclosure procedures. The net result was that the current information-sharing treatment was practically the same as the future information-sharing treatment. However, participants noted that the information-sharing mechanics of future information sharing—where all information released to a nation was available in the coalition and national shared spaces—potentially enables better collaboration.

In addition, the injects that participants received at the beginning of each vignette to process for release were created prior to the CISP3 meeting, so their decisions did not affect many of the disclosures. Week 2 offered no injects that required nations to exercise disclosure procedures, regardless of the intelligence exchange requirements.

Finally, CISP3 unanimously decided to list exceptions to automatic release rather than to develop explicit items for automatic release. This was a laudable attempt to reduce the administrative burden on SoSAs and planners as they determined if a piece of information could be released without going through a formal disclosure process. However, this could have influenced the employment of the future information sharing by making it more like current information sharing.

The MN LOE II was the first opportunity to exercise the MNIS OPCON. The LOE design team tried to represent faithfully the intent of the OPCON within the LOE bounds, while not significantly affecting the ONA portion of the experiment. The LOE yielded useful insights that will be used to mature the MNIS OPCON.

F. DATA COLLECTION AND ASSESSMENT METHODOLOGY

The assessment team was organized to support the analysis functions of the experiment: assessment planning, data collection, data analysis, and results reporting. All partner-nation analysts were integrated into the JFCOM analysis team to contribute to the assessment process, from planning to reporting. The fellowship and excellent professional and working relationships among the members of the experiment analysts working group yielded interactions, discussions, and cultural differences that fostered and contributed to the MN LOE II program and to its resultant success.

The hierarchy of data flow and organization for the experiment analyst team that was used for planning and execution is depicted in Figure 5. Since this was a U.S.-led experiment, the government lead and the analysis division chief are from the U.S. Specific billet descriptions and responsibilities follow.

Process Observers. The analysis process relied upon a team of observers who were functional experts—military and civilian—in one or more relevant areas. They had technical expertise and experience in a particular service/joint military operation, unit, organization, weapon system, C4 system, or process at the tactical, operational, or strategic level of war. Observers were culled from each of the coalition partners, based upon their acknowledged expertise in conducting observations and in collecting data.

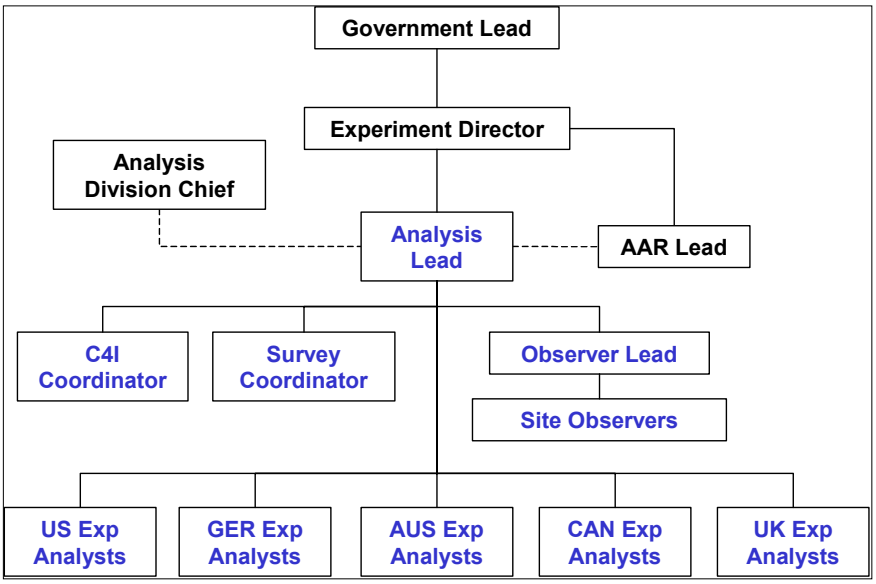

Figure 5. Experiment Analysis Organization

Observer Lead:

- Directed, coordinated, and interfaced with site observers regarding data collection and responsibilities
- Discussed issues with site observers to provide them with feedback and to solicit their comments during the experiment
- Conducted daily feedback meeting with site observers
- Provided hot-wash observations to the experiment analyst lead via Groove e-mail
- Coordinated the timely submission of surveys.

Site Observers:

- Followed the directions of the lead observer
- Submitted insights from over-the-shoulder data collection to the database; ensured focused, efficient, complete, and accurate collection of specific data elements
- Submitted comments and recommendations to the database that surpassed the original scope of survey questions
- Ensured the timely completion of surveys
- Ensured that the product remained militarily relevant and accurate.

Experiment Analysts. Military and civilian analysts had operations research/systems analysis training or practical analytical experience. They were involved in all phases of the analysis process: planning, collecting, analyzing, and reporting.

Analysis Lead:

- Reported to the experiment director and the analysis division chief
- Controlled overall assessment planning, execution, and reporting, and ensured that collection and analysis efforts met the intent of the experiment director
- Developed the analysis plan, methodology, collection, analysis, and reporting
- Coordinated with partner nations' experiment analysts
- Provided information to the after-action review lead.

C4I Coordinator:

- Reported to the lead experiment analyst
- Coordinated all of the data collection efforts for the ONA database and Groove, ensuring adherence to the overall data collection plan
- Helped to develop the analysis plan and methodology
- Coordinated the analysis of data regarding the C4I systems.

Survey Coordinator:

- Reported to the lead experiment analyst
- Administered all surveys via the Joint Battle Center (JBC) Data Collection and Analysis Tool[7] (JDCAT), ensuring timeliness and minimizing delinquency rates
- Helped to develop the analysis plan and methodology
- Collected comments and recommendations from the database
- Collated survey data
- Coordinated timely submission of surveys.

Experiment Analyst:

- Reported to the lead experiment analyst
- Ensured that collection and analysis efforts met the intent of the experiment director
- Obtained from observers the practical, military, tactical/operational/strategic level of war relevance and insights for the collection and analysis processes
- Helped to develop the analysis plan and methodology
- Monitored, reviewed, and ensured accurate, complete, and timely data collection.

[7] JDCAT is a survey data collection tool developed within the Joint Battle Center (JBC) at USJFCOM. Version 3.1 was used for MN LOE II.

1. Data Collection Strategy

Data from various sources was needed to evaluate adequately the objectives and COIs of the MN LOE II. The extensive data collected included each partner nation's contributions to various sections of the collection plan.

a) *Collection Plan*

The experiment generated both qualitative and quantitative data needed to gain perspective of the ONA process and MNIS, specified in the data collection matrix in Appendix F.

Qualitative data included participant and observer surveys, over-the-shoulder observations collected by designated observers, senior concept developers' insights and observations, hot washes, and after-action reviews. Surveys used scale response questions, and provided space for additional comments, which were grouped by topic for consideration of their impact on ONA and MNIS. All participants and observers also were encouraged to submit comments and recommendations. Additionally, senior concept developers from each coalition partner nation offered insights and observations of human factors and processes during several one-hour sessions each week. See Appendix D for more information on SCD usage.

Quantitative data included ONA-database-access review, over-the-shoulder observations collected by designated observers, and outputs from Groove about collaboration proceedings. An audit log of the server that houses the ONA database was used to review records of access to the ONA database, revealing users and changes made. Participant access of other ONA knowledge-base components was also reviewed. Observers used over-the-shoulder data collection forms to record specified events of interest.

Data collected from human factors observers spanned the qualitative and quantitative spectrum in a review of the ONA process. Situational awareness probe questions were administered to all players at all multinational sites to establish the task information source within the extended multinational ONA team. In addition, players' workloads were determined during the multinational ONA development process. Next, organizational interoperability questions covered higher-level, nontechnical aspects, such as cultural factors, that may impede such a working cooperation.

b) *Data Management*

All collected data was accessible to all participating nations' experiment analysts, and analysis and findings were shared in a post-experiment workshop. As part of the post-experiment management plan:

- Senior concept developer insights, observations, and interview results were collected and maintained in Word documents and in JDCAT.
- Data from participants, senior concept developers, and observer surveys, as well as comments and recommendations, was stored in JDCAT.
- Audit log data from the ONA database server was transferred to an Excel spreadsheet.

- User products, such as chat sessions, generated via Groove during execution, were stored and maintained in a Word document or an Excel spreadsheet.
- The audit log from Groove was maintained in an Excel spreadsheet.
- The situational awareness probe and the workload data were maintained in an Excel spreadsheet.

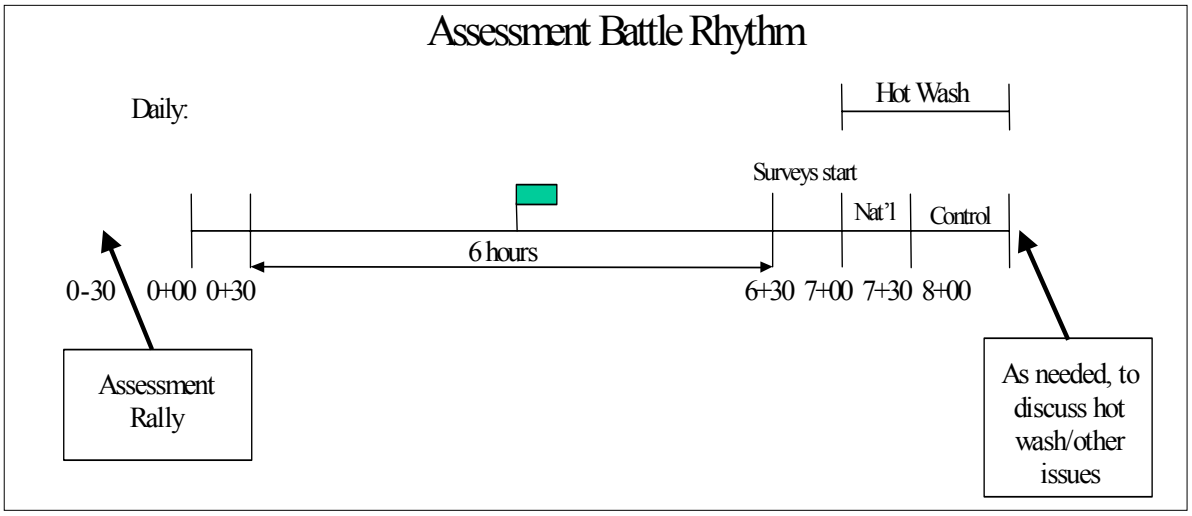

Figure 6. Daily Analysis Battle Rhythm

c) *Analysis Battle Rhythm.*

The analysis battle rhythm was built upon the eight-hour "Experimentation Day." See Figures 6 and 7. All analysis meetings were conducted collaboratively via Groove.

Assessment Rally. The assessment rally was a daily kickoff meeting to review highlights of the previous day and to give assignments for the day. All experiment analysis personnel attended this virtual meeting.

Flagged Meeting. At any time during the experimentation day, analysts could report any unusual occurrences in an impromptu meeting or individual conversation, as needed.

Post-Vignette Insights and Adjustments. Also during assessment rallies, analysts gave insights and recommendations for necessary adjustments following each vignette. They were prepared to answer the questions: "What did we learn from the last vignette?" and "What do we need to do to adjust for the next one?"

Post-Hot Wash Meeting. Analysts participated directly in hot washes, but post-hot wash meetings were not required.

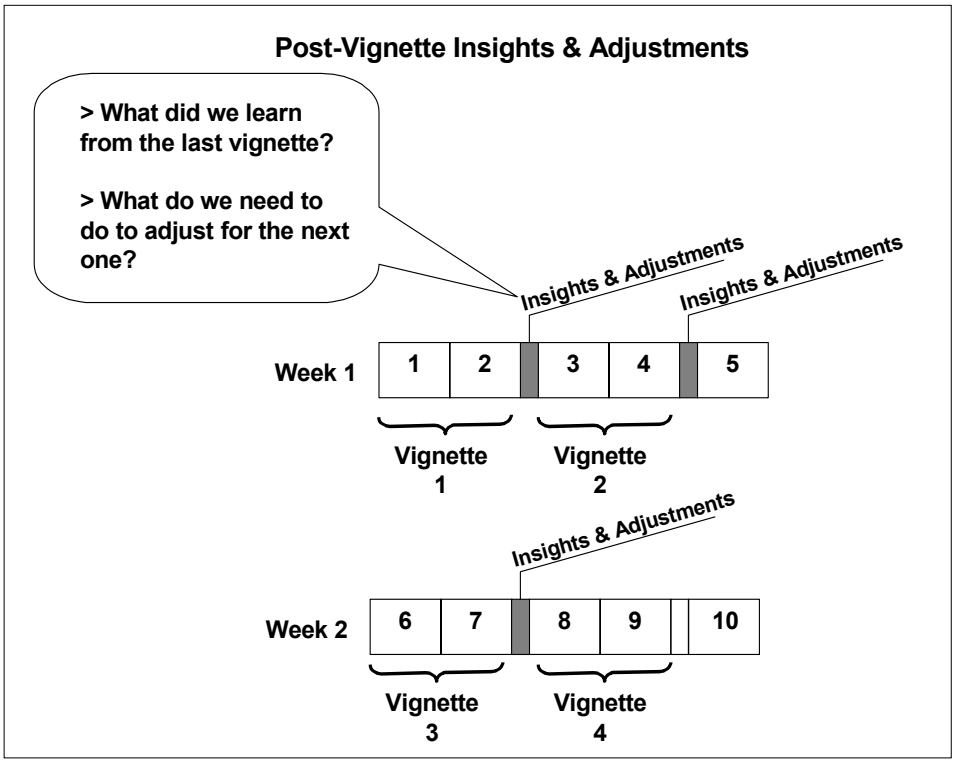

Figure 7. Post-Vignette Insights and Adjustments

2. Human Factors Plan

A human factors methodology measured changes in participants' situational awareness. *Situational awareness* is a person's perception of the available information and his understanding of the immediate situation, his projection of future situation, and his understanding of how to resolve the problem. A measurement of the participants' awareness of the shared information was used to compare the effectiveness of information-sharing methods in the experiment. To chart the development of situational awareness over time, participants responded every two hours to five probe statements as true or false. Additionally, participants rated their need to know a certain piece of information, their actual knowledge of it, and who else should know it. The probes presented facts regarding the current scenario but did not reveal information, breach the information-sharing boundaries, or bias the experiment.

The questionnaires were available on the human factors Web site to be completed at the prearranged time (two, four, and six hours into the experiment day). When the human factors observer at each site announced a break for probe questions at the requisite time, players visited the Web site using Internet Explorer, entered their call sign and the question set number, and completed the questions.

Each probe statement required four responses:

1) Is this relevant to your task/role? (yes, maybe, no)
2) Is this true or false?

3) What is your level of confidence in the true/false response? (very low, low, medium, high, very high)
4) Which other countries will answer this probe most correctly? (AUS, CA, GE, RE, UK, US)

Participants completed the questions in silence, without consulting other participants or the ONA database. They also did not discuss the questions after presentation. If a player did not know the answer to a question, he guessed at the true/false response and then indicated he was guessing by marking "very low" on the confidence scale.

The probe statements were compiled from baseline information in the ONA database and in the vignette brief, and from information that had been added as new injects during the experiment. Two "distracter" probes should have been answered correctly by every participant, regardless of the information-sharing condition or the release of information from other nations. The remaining three probe statements were releasable, subject to the relevant information-sharing agreements.

Each probe question underwent a variety of checks prior to its use:

1) The probe questions were formulated initially from the inject materials and background information to test knowledge of a specific piece of information, without giving away any information to a participant who had not read the inject. Equal numbers of true and false probe statements were formulated, ensuring that false statements did not rely solely on use of a negative in the statement.
2) Possible probe statements were submitted to three different criteria tests:
    a) Ten individuals with no knowledge of the experiment or the scenario rated each statement as either true or false. Since the probe statements were related to a fictional situation in 2010, this group answered the questions "blindly" and therefore relied on the structure of the sentences and use of language to guess the answer.
    b) The German human factors lead also assessed each statement for its level of language difficulty, ensuring that the nonnative-English speakers could understand the statements. Each statement was rated for "language difficulty" on a scale of 1–5.
    c) An intelligence specialist observer from the UK white cell reviewed the probe statements for operational significance on a scale of 1–3.
3) The final selection of possible probe questions included only those statements that received an equal rating of true and false responses in a) above, a score of 1-3 in b) above, and a rating of 1-2 in c) above.
4) These statements were submitted to the analyst lead at JFCOM in the United States for final approval and then were considered suitable for use with the participants.

The timetable of probe statements contained equal numbers of statements asked about information released to each nation. Each statement from experiment day one was

repeated between presentations in order to assess the amount of growth in understanding during a set time period. Furthermore, each presentation assessed information in different ONA areas—nodes, actions, resources, or effects—and different nations of interest in order to balance the individuals who should answer each statement correctly.

3. Assumptions

During the planning and execution of MN LOE II, some assumptions were made that could have affected the conduct of the experiment and resulting analysis. As in any experiment or analyses, these fundamental assumptions were required for the successful execution of the experiment:

- Personnel have the requisite education, training, and experience to perform their duties.
- Sufficient training would be available to assigned personnel to allow them to become familiar with the concepts and tools to be used during the experiment.
- The political climate of the region depicted in the 2010 scenario was selected.
- Week 1 of the experiment depicted the current method of information sharing.
- Week 2 of the experiment depicted the future method of information sharing.
- The use of experiment injects would result in a sufficient amount of information sharing to determine differences between Week 1 and Week 2.

4. Limitations

During the planning, execution, and analysis phases of the experiment, all of the qualities and requirements of MN LOE II were combined to meet the experiment objectives, resulting in recognized limitations that could influence the conduct of the experiment and the validity of the results. Some limitations grew out of existing technical shortfalls, while others, sometimes referred to as *delimiters*, intentionally produced specific opportunities to explore the concepts and to meet the experiment objectives. Still others were used to balance and prioritize diverse requirements. Consequently, the existence of limitations does not mean necessarily that they had a negative impact on the validity of the experimental findings.

These limitations exemplify the difficulty of replicating any scenario in an experimentation environment. Ideally, the experiment concepts would have been applied within the experiment exactly as the concept developers envisioned them. However, this was not always so. Concepts are futuristic by their very nature, and in some instances, they are ahead of available technology. Thus, the assessment of a concept is relevant to the degree to which it is accurately applied in the experiment.

These limitations emerged during the MN LOE II planning, execution, and analysis:

- The experiment was executed using six hours of operation per day instead of 24 hours of operation per day.
- Assessors used some intrusive means to collect data.
- A lack of a command structure existed within the participating nations. In some cases, this resulted in a lack of national guidance and direction that detracted from the experiment objectives.
- Limited access to information sources outside of the experiment during the execution period detracted from the ONA process.
- A lack of detailed procedures existed for the execution of the ONA process in a multinational environment. Those that eventually were developed and promulgated were deemed acceptable, but only for the experiment. Further work is required in this area.
- MN LOE II was a single, one-time experiment without multiple trials.
- Differences existed between the actual concepts and the way they were operationalized in the experiment.
- Participant training and knowledge of the concepts was less than may be expected upon fielding of the concepts.
- The ONA tool was marginally populated with information at the beginning of the experiment.
- Specific statistical results of the study will hold true only for scenarios with a similar construct. Inferences drawn from the statistics are related to the concepts tested.
- The scenario was notional and occurred in the future.
- The security domains tested within the experiment were notional within the Groove network. Information was not shared across real-world security domains.

5. Assessment Methodology

All data collected was broken down into quantitative or qualitative categories. Qualitative data was analyzed for trends and commonalities in opinions and insights and for differences in rating metrics produced by the given scales. Quantitative data was analyzed for time and event frequencies of the ONA planning process. The sources for all qualitative and quantitative data are detailed for each objective in Table 2. For this experiment, *qualitative data* is subjective appraisals of events by participants and observers, distilled with their experience and judgment. *Quantitative data* is objective measurements of events from nonjudgmental observers or from instrumentation.

The quantitative source of analyzed data is the ONA knowledge base activity recorder. An audit log of the Structured Query Language (SQL) server that housed the ONA database was used to collect participant access to the stand-alone ONA relational database. This log

identified the user and changes made. A Groove log also was used to collect information on Groove tool and space usage. To clarify findings as they emerged, all of these collected data were matched against the COIs that supported the experiment's two main objectives.

	Qualitative Data (Subjective)	**Quantitative Data (Physical Measures)**
Objective 1 ONA in MN environment	Web-Based Surveys - Rating scale (SCD, observer, participant) + Opinions & Insights - Survey additional comments - Interviews - Comments and recommendations - AAR/hot-wash minutes (SCD, observer, participant)	Frequency of database accesses and changes (C4I systems)
Objective 2 Info Sharing Across Security Domains	Week 1 vs. Week 2: Web-Based Surveys - Rating scale (SCD, observer, participant) + Opinions & Insights - Survey additional comments - Interviews - Comments and recommendations - AAR/hot-wash minutes (SCD, observer, participant)	Week 1 vs. Week 2: ONA SQL server audit log (access/changes) + Over-the-shoulder observations (Observer data sheets) + Groove server audit log (Tool and space usage) + Targeted questions about SA Perceptions vs. ground truth (participant)

Table 2. Qualitative and Quantitative Data for Objectives 1 and 2

The assessment methodology differed slightly for the two objectives:

Methodology for Objective 1. Qualitative data was used to assess the workability of the ONA process in a multinational environment. The analysis was not based on a comparison, but on whether the process works.

Methodology for Objective 2. Both qualitative and quantitative data was used to compare current with future methods of information sharing. Targeted questions concerning situational awareness also were analyzed for differences between perceived

and ground truth. The analysis here was based on comparisons of performance measures for each information-sharing method. Qualitative and quantitative results should agree.

Furthermore, an experiment analysis workshop was convened to enable all analysts to contribute their inputs to the analysis process. Partners came prepared to discuss their insights and to present their independent analysis of the experiment. For the results of this workshop, see Appendix A.

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IV. MAIN EXPERIMENT FINDINGS

A. OBJECTIVE 1 DISCUSSION

Identify and assess issues associated with the ability of national headquarters staffs to conduct a distributed ONA.

1. Objective 1 Overall Assessment Results

The MN LOE II demonstrated that a multinational coalition could successfully conduct the U.S. ONA process in a distributed environment under controlled experimental conditions. The mechanics and procedures of the process worked well, except for a few needed refinements. Some more advanced issues need resolution that requires a better examination of national, non-U.S. perspectives.

Major problems included time constraints that prevented significant exploration of national views, a lack of national command-and-control organizational structure to allow consideration of true national postures, and a lack of conflict resolution ability in a collaborative environment. These kinds of concerns—at the heart of multinational cooperation—began to surface in collaborative discussions but were not explored. Until they are explored more fully, the ability of nations to collaborate cannot be fully appraised. Thus, even though experiment findings suggest the U.S. ONA process is compatible with other European-based cultures, higher-order cultural and organizational issues—also central to multinational coalition operations—need further exploration in future experiments.

Benefits from multinational partners included a wider range of options proposed to achieve objectives, few language barriers, and overall willingness to participate in a coalition operation. Lingering issues persist in two major areas. First, if nations disagree on the selection of PMESII options, how could this conflict be managed and resolved to preserve the coalition objectives? Second, how will nations define the architecture of their own "ONA organization" and its links to their national agencies, and how will they establish the crosswalk between elements of their ONA organization and corresponding elements of other-nation ONA organizations? Without the opportunity to explore these questions, conclusions drawn about cultural and organizational factors that affect a multinational ONA process are rudimentary at best.

2. COI 1.1 Discussion – Is the U.S. ONA process viable in a coalition environment?

a) *COI 1.1 Assessment Results*

With the appropriate tools and information-sharing policies and procedures, the ONA process can be performed in a coalition environment. Overall, the ONA process

was well received by experiment participants, who considered it to be viable in a coalition environment. Adequate training on the process, tools, and standard operating procedures is essential; staff availability and use of the distributed network presented training obstacles. Even within the same nation, training levels of players varied.

Most player survey responses indicated positive reactions to the ONA process, with reservations expressed within these general comments:

1) A more robust voice communication capability is needed to support collaboration.
2) Collaboration procedures must be structured more effectively.
3) The ONA process was not fully tested for multinational use.
4) The role of national interests must be addressed to a greater degree.
5) Consensus and conflict resolution were not explored sufficiently.
6) Other nations perceived a U.S. bias toward military approaches to problems.

These general reservations comprise those that pertain to lower-level, easily resolved issues, such as mechanical and procedural concerns, and those that pertain to higher-level issues, such as national perspective, that are at the heart of the multinational arena. Given the limited experiment goals of demonstrating and exploring the basic ONA process in a multinational setting, the process was shown to be viable under the experiment conditions.

b) *COI 1.1 Findings*

(1) Finding 1 → All data considered, the experiment participants indicated that the basic ONA process is viable in a coalition environment.

The majority of survey respondents across nations agreed that the U.S. ONA process is viable in a coalition environment. (See Figures 8 and 9.) Due to the departure of some players, the total number of responses decreased slightly from Week 1 to Week 2. In addition, the percentage of participants who agreed dropped from 90 percent in Week 1 to 73 percent in Week 2. This decrease may be due to participants' better understanding of the complexity of the ONA process by the end of the experiment. Nevertheless, the percentage of positive responses for the two weeks is still markedly higher than the percentage of negative responses.

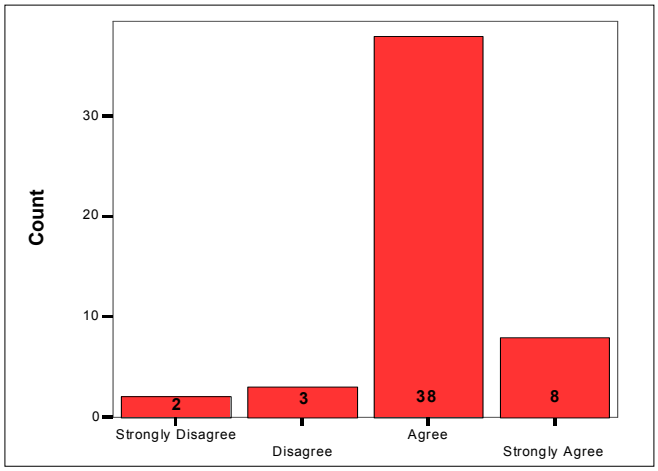

Figure 8. The U.S. ONA process is viable in a coalition environment (Week 1).

During the experiment, players who performed the ONA process quickly grasped the basic mechanics and expressed a drive to move forward to tackle more sophisticated issues. These results emerged despite a plague of voice communication problems with the collaborative tool used in the experiment. The basic process was feasible across continents under these poor circumstances, underscoring its potential in more optimal settings.

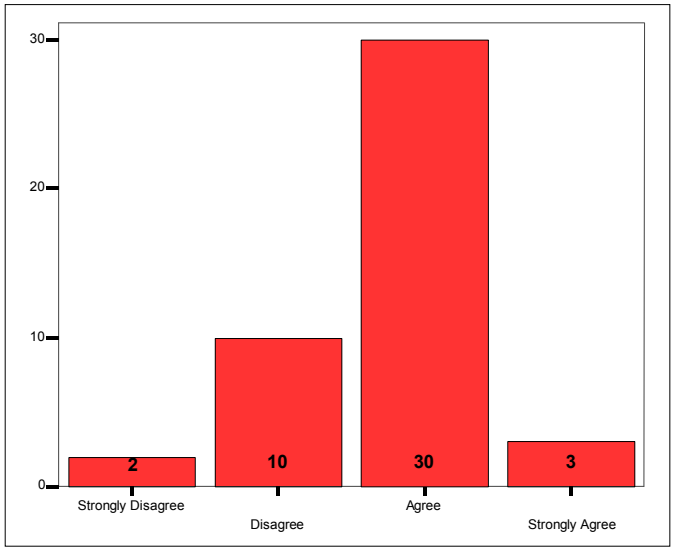

Figure 9. The U.S. ONA process is viable in a coalition environment (Week 2).

(2) Finding 2 → The ONA process requires a robust, distributed, collaborative environment, including voice, text, and visualization capabilities.

Various tools are needed to effectively facilitate distributed multinational collaboration. Participants complained that the collaborative tool used in the experiment had an inadequate voice capability that could not support collaboration by a large number of players.

Most participants blamed the Groove tool specifically, while others pointed to inadequate bandwidth allocated on the CFBL net; the source of the communication problems is unclear. But clearly, ONA must be supported with a secure, reliable, robust, flexible collaborative tool or tools capable of supporting large collaboration groups. The problem was exacerbated by the artificial constraints on the use of the Groove tool/capability due to the collaboration business rules.

The ONA database tool was deemed cumbersome and not particularly friendly, which led to the observation that the experiment became more of an exercise in feeding and maintaining the database than in exploring the ONA process and its potential to assist decision-makers in gaining insights and knowledge.

The problem was mitigated somewhat by procedurally limiting the number of speakers and by using interactive text. But this slowed communication and caused players frustration and confusion by losing track of conversations conducted in text mode. This particular concern could have been resolved through a threaded discussion capability.

Some players' comments included more than simple tool inadequacies, raising the general subject of future equipment interoperability across 26 NATO nations.

(3) Finding 3 → Collaboration business rules must be defined in detail, taught in advance, and practiced regularly to support successful multinational collaboration.

Business rules were poorly defined prior to the start of the experiment and lacked sufficient detail to adequately support the coalition collaboration process. They continued to evolve and were refined during the three trial weeks.

As the experiment began, the participants followed a U.S.-developed ONA concept and process, which the business rules supported. As the ONA process became more multinational, the business rules accommodated those process refinements. Further, the rules were adapted for the technical limitations of the collaboration tool suite and of the ONA database. Participants noted that implementation of a notional command structure in each of the participating nations would have supported the experimental play and could have solved some of the problems in business rule definition and implementation.

In addition, a trained, effective, and experienced moderator or session leader is critical to the smooth and efficient conduct of collaborative sessions.

(4) Finding 4 → Further testing of the ONA process is needed within the multinational arena.

Comments suggested that the experiment did not explore some elements of ONA viability in a multinational environment. Participants said that the experiment explored only the mechanical and basic procedural requirements to conduct the process. Comments included:

- Multinational communications and a fairly primitive decision-making tool were tested and found to be just above adequate.
- How scalable is the ONA process—i.e., how many nations/organizations can participate in the process before it becomes unworkable or before the results deteriorate?
- Participants spent all of their time developing the procedures to try to get to the concept; they did not think that they ever got there.
- Instead of experimenting with multinational ONA process procedures, participants developed them during the experiment. This limited the ability to truly assess viability.
- Three nations (CA, DE, and UK) were separately exploring their own effects-based operations processes and thus had a different opinion of how ONA should work.

(5) Finding 5 → Incorporation of national guidance and objectives is needed.

The issue of national perspectives was not played during the experiment, although participants and SCDs frequently cited it as being central to determining ONA viability. Players were unsatisfied with the ability to coordinate a national position within the ONA process. Under the current information-sharing method, a synthesis of different national procedures and a multinational linking of nationally shaped information are needed. Participants' comments included:

- The process needs considerable work, including a realistic way of capturing national positions/perspectives, which is critical.
- Incorporation of national perspectives at a greater level would improve the quality of the data and linkages incorporated in the ONA.
- We need a multiagency approach, including government representatives empowered to make decisions on government policy.
- Some type of commander role is needed within each nation to structure the interactions from a national perspective to maintain sovereign positions.

(6) Finding 6 → Consensus and conflict resolution were not explored sufficiently.

According to participants and SCDs, conflict resolution and consensus-building among nations during collaboration also require more in-depth examination. These issues received some play, but unfortunately were abbreviated due to time constraints. Along with the issue of national perspectives, these two primary issues for multinational viability went unapprised.

Comments included:

- "Real issues related to debates and conflict resolution [were] not addressed."
- "The issues to date have not been contentious enough to really test the decision-making system."
- "There must be an emphasis on the 'coalition' part—joint decisions, made by consensus, that work on behalf of the entire coalition."
- "[The] U.S. ONA process can't run over the national decision-making processes."
- "There needs to be specific attention paid to international recommendations."
- "Participating countries do not fundamentally agree on the nature of this situation: [The] U.S. has an emphasis on the military aspects ... other countries on diplomatic and economic aspects ... A philosophy of 'agree to disagree' is not appropriate for having a coalition of countries working together to make decisions."

(7) Finding 7 → Because of time constraints, the experiment did not fully explore all phases of the spectrum of conflict or diplomatic, information, military, and economic (DIME) actions, and chose to focus on military actions.

This perception is based on these specific trends in player comments:

- U.S. players made pronounced attempts to deemphasize military solutions during collaboration with other nations, but the bias was perceived by the partners anyway.
- Excellent discussions concerning shaping effects occurred on the first day of Week 2 in Vignette 3 among multinational planners, SoSAs, and U.S. planners. U.S. planners indicated that the "worst case" military effects should be discussed first. Multinational partners disagreed, saying that the emphasis should be diplomatic and economic.
- An entity like the joint interagency control group clearly was needed to address diplomatic and economic aspects among partners. International partners preferred ENAR linkages that addressed political and economic actions, whereas the comfort zone of the U.S. was deliberate military planning.
- U.S. planners exceeded the intent of the experiment objectives and planned for military operations. They did not explore the diplomatic, information, and economic options, except as support to the military operations. U.S. planners need to broaden their thinking beyond their military comfort zone.
- Even the U.S. names of the phases of the spectrum of conflict—influence, deter, coerce, compel, defeat, instead of negotiate or entice—were perceived by the partners as completely militaristic.

3. COI 1.2 Discussion – What are the impacts of cultural and/or organizational differences on coalition collaboration?

a) *COI 1.2 Assessment Results*

Cultural differences resulted in a positive contribution to coalition collaboration and ONA product quality. Different cultural perspectives brought to the ONA process a wider range of potential options and solutions. However, even though all but two of the participating partner teams were composed entirely of native English speakers, the use of slang terms, military jargon, acronyms, and different usage and definitions for the same words in the different nations resulted in occasional misunderstandings.

In a coalition with many more members or one in which participants had more diverse political, military, and social customs, the degree of cooperation in this LOE could be more difficult to achieve. The presence of more nations increases the quantity of information available and thus the complexity of collaboration and coordination.

An information-sharing "culture" must be cultivated in each of the partner nations. Personnel must be well prepared by education, training, and experience to deal with the complexity or diversity of issues that typify the ONA process and the effects-based approach to operations that it supports.

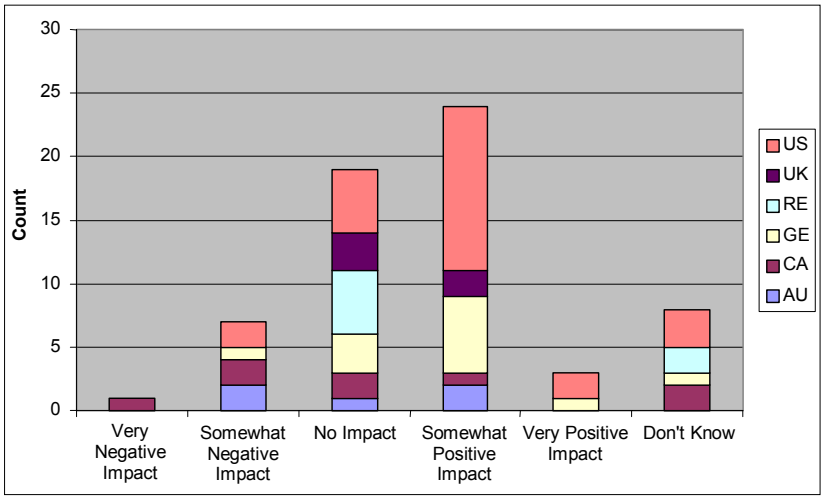

Figure 10. Impact of Cultural Differences on Collaboration

Coalition partners remarked on the U.S. dominance of the ONA development process, which resulted in a lack of shared meaning of fundamental terms. Coalition partners also noted the U.S. proclivity to jump to military actions before fully exploring all diplomatic, economic, and political options. U.S. comments supported this dominant position, since ONA was a U.S.-developed tool. Such an approach potentially may affect multinational collaboration negatively.

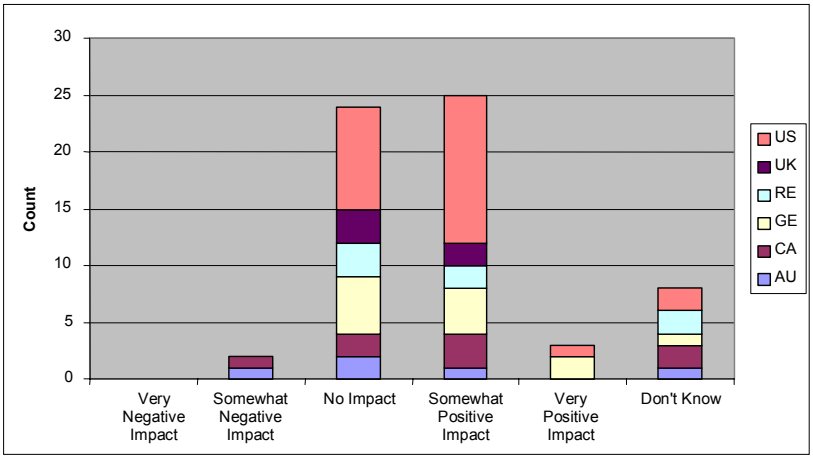

Figure 11. Impact of Cultural Differences on Database Quality

Each partner nation implemented its ONA cell at different levels in its national military organization, resulting in a slightly negative impact on the coalition collaboration process and on ONA product quality. Difficulties were manifested primarily in the different manning levels for the partners, which did not always allow them to have expertise in all of the required analysis and planning disciplines, and which did not allow them to participate fully in all of the required collaborations.

In order for ONA to be implemented successfully in a multinational collaborative environment, each partner nation must determine its own internal ONA structure and must develop an understanding of the differences in organizational structure and function.

b) *COI 1.2 Findings*

(1) Finding 1 → Cultural differences had an overall positive impact on coalition collaboration and on ONA product quality.

The coalition member nations in this experiment share a European-oriented cultural background, similar military traditions, a long history of working together, and quickly created, trusting, and cooperative working relationships. Participants perceived that the differences in national cultures had an overall positive impact. Players believed that, because of cultural similarities, commonwealth countries generally worked well together and supported each other. Differences between civilian and military cultures potentially could have greater impact than differences among partners' military cultures. Some partners preferred a more rigid, structured approach to the collaboration process; some preferred a more flexible, loosely structured approach. See Figures 10 and 11 for the survey results.

Participants observed that cultural input, disagreements, and agreements reduced and discouraged projecting partner values onto those of the potential adversary. Encouraging multiple views from different cultural perspectives helped to avoid the tendency to believe that an adversary thinks like we do, and then to be surprised when he does not.

(2) Finding 2 → A common language and use of common terms are required for successful collaboration.

Misunderstandings that resulted from use of slang, jargon, acronyms, and even common terms hindered communication somewhat. Most significantly, national partners understood the U.S. ONA terms *effects, nodes,* and *actions* differently. As one regional player observed, "Language differences hindered the speed at which you [could] work and the degree of understanding you could achieve on certain matters." The participants used six different versions of English, and their range of civilian and military backgrounds led to gaps in assumed knowledge and differences in the terminology used. For example, a U.S. team member commented that he was "not familiar with all military terms," and another player offered that "…there are distinct jargons for military personnel, systems engineers, civilian area specialists. It is, on occasion, difficult to recognize all of these as being in English."

Open discussion by the participants and implementation of effective business rules overcame these misunderstandings. However, a permanent awareness of the presence of non-English-speaking participants is necessary. Language accommodation skills are required, such as speaking slowly, not using unusual terms or complex phraseology, and allowing time and opportunity to clarify questions and answers. Incorporation of a near-real-time translation capability may alleviate some of these concerns.

(3) Finding 3 → Collaboration may be more difficult when the group is larger and more culturally diverse than that of this experiment.

Participants noted that, in a coalition with many more members, or one in which participants had a wider variety of political, military, and social customs, the degree of cooperation that was observed in this LOE would be more difficult to achieve. The

presence of more nations increases the quantity of information available and the complexity of collaboration and coordination.

(4) Finding 4 → A philosophy to share information to the maximum extent possible must be cultivated among all nations within the ONA process.

A philosophy of collaboration that rewards sharing should be the standard rather than the exception within organizations and governments, as well as among nations. The tendency to restrict the disclosure of possibly sensitive information should be avoided. Withholding information must be minimized in a multilateral collaborative environment.

(5) Finding 5 → U.S. dominance of the collaborative process potentially could affect coalition collaboration negatively.

Coalition partners remarked on the U.S. dominance of the ONA development process and on the U.S. proclivity to jump to military actions before diplomatic, economic, and political options had been considered. U.S. comments supported this dominant position, since ONA was a U.S.-developed tool. Participants indicated that some nations eventually "gave up" suggesting nonmilitary actions because the U.S. repeatedly argued them down, leading them to feel that their input was "useless."

These comments reflect previous research showing that U.S. officers are less knowledgeable about other cultures than are their multinational counterparts[8]. Most players had received no formal training on cultural differences and awareness. Such an approach potentially may affect multinational collaboration negatively.

(6) Finding 6 → Organizational differences had a slightly negative impact on the coalition collaboration process and on ONA product quality.

Each partner nation implemented its ONA cell at different levels in its military organization. Nations involved in the experiment used different command-and-control structures and processes that may influence some partners' ability to act in the collaboration process.

Organizational difficulties were manifested primarily in partners' manning levels, which did not always provide expertise in all required analysis and planning disciplines, and which did not allow them to participate fully in all of the required collaborations. Although the difference in manning levels may have been an artificiality of the experiment, many believed that real-world implementation still would result in significantly higher staffing levels for the U.S. and potentially could result in a U.S.-dominated process, particularly during precrisis operations. If the outcome is to be based on a consensus, then undermanned national teams would need additional time to review collaborative work in which they were not able to participate.

[8] Bowman, Elizabeth K., and Pierce, Linda G. 2002. Cultural barriers to teamwork in a multinational coalition environment. Poster presentation at Army Science Conference, December 2002.

Canada's participants commented, "Among the challenges ahead, partner nations will need to develop understanding of differences in organizational structure and function, which result in the placement of partner's ONA capabilities at different levels in their governments." This drives the requirements for policies and procedures to support coalition collaboration and information sharing.

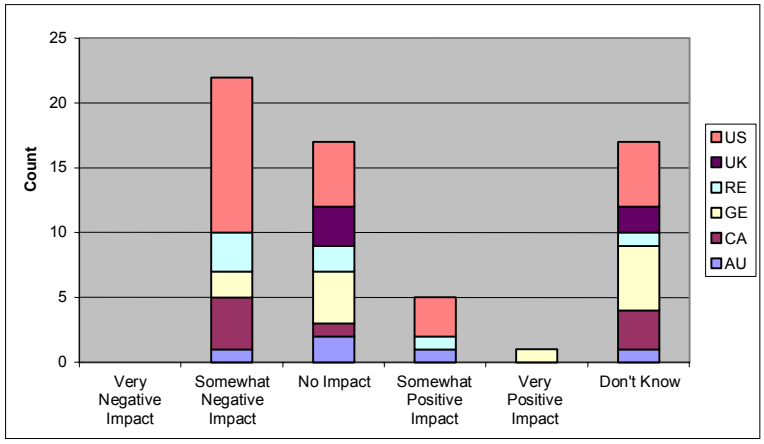

Figure 12. Impact of Organizational Differences on Collaboration

National perspectives generate conflicting choices for DIME options in seeking to satisfy a common coalition objective. This will complicate the ONA process, but ideally, it will lead to superior coalition decision support and planning. Figures 12 and 13 depict the perceived impact of organizational differences.

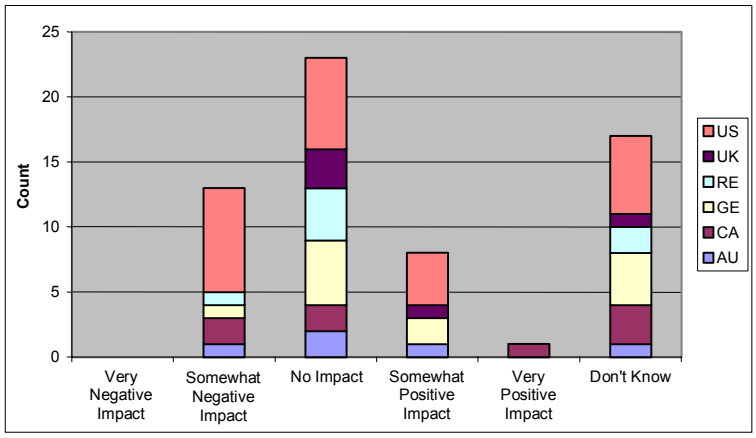

Figure 13. Impact of Organizational Differences on Database Quality

(7) Finding 7 → Each participating nation must determine its own internal ONA structure.

In order for ONA to be implemented successfully in a multinational collaborative environment, each nation must determine its own internal ONA structure and/or similar process, since each partner's ONA capabilities are likely to reside at different levels in its government. Each partner nation must understand of these differences in organizational structure and function.

Access to other government agencies is central to the implementation of ONA for each nation, as well as the establishment of links to other resources, academia, and nongovernmental agencies—repositories of information that is not well represented in the government. Processes and tools must be flexible to accommodate each nation's internal ONA methods, driving the requirements for procedures and policies to support coalition collaboration and information sharing at varying levels.

(8) Finding 8 → Participants in multinational collaboration require specific training and experience to make the process effective.

Participants must be well prepared through education, training, and experience to deal with the complexity and diversity of issues that typify the ONA process and the effects-based approach to operations that it supports. In addition, collaboration session leadership and moderating require specific skills and training. Players emphasized the importance of face-to-face meetings among participants in helping to build personal confidence and trust.

B. OBJECTIVE 2 DISCUSSION

Identify and assess issues associated with collaboration and information sharing across different security domains.

1. Objective 2 Overall Assessment Results

MN LOE II identified collaboration and information-sharing issues among multinational partners. However, the experiment did not provide the structure needed to assess the efficacy of the CISP3 process and the new security domain architecture. Thus, the consensus among all participants and experiment analysts is that this objective fell short of its goal.

The reliance on an unclassified data repository did not force a hard look at what can and cannot be released, or at the reasons behind those determinations. Information-sharing issues were subject to, and unduly influenced by, current information-sharing rules that are too general and encompassing in their restrictions. The applicable rules were not adequately distinguished by the context and the need for secrecy. The fear and perceived risk that motivates this approach to information sharing must be alleviated through the realization that fully effective collaboration requires a change in philosophy and policies. Future experimentation faces a challenge to use real data and issues. Furthermore, the eventual real-world implementation of a multilevel security (MLS) network and database is needed to support any MNIS concept of the future. The MNIS concept, as played in this event, assumed the presence of a MLS network and database.

The experiment provided a starting point for further development of solutions to the information-sharing problem. It produced evidence to support the possibility of strong international collaboration using the ONA process, given appropriate tools and information-sharing procedures and policies. If nations can collaborate and share information during peacetime, improved situation awareness may result, leading to superior decision-making. Nations should sustain an open dialogue to identify information-sharing impediments that restrict collaboration.

Participants observed that the CISP3 and the future information-sharing process did not consider the various non-U.S. national policies and procedures for the release of classified information in a multinational environment. Partner nations did not portray

their own national policies, and so the resulting procedures, when applied by non-U.S. players within the experiment, were artificial and constrained.

2. COI 2.1 Discussion – Does collaboration with coalition partners across security domains improve the ONA?

a) *COI 2.1 Assessment Results*

Collaboration with coalition partners across security domains potentially could improve the ONA. In this experiment, the new cross-domain, information-sharing concept was not sufficiently tested or assessed. Instead, the experiment focused on the care and maintenance of the ONA database rather than on the exploitation of the information available. The experiment became driven more by the nodes and links than by the investigation of ONA's benefits and potential. Security domains were not stressed or sufficiently enforced to address the potential situations and implications. Most of the discussions during the first and second weeks occurred in the coalition space. Figure 14 depicts the number of visits to, or use of, each shared space, including quick visit-and-depart activities.

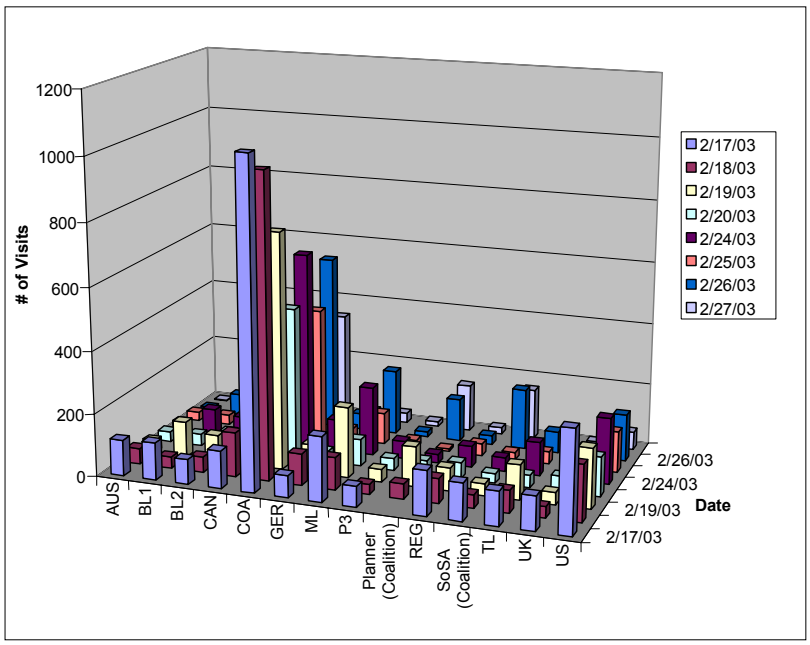

Figure 14. Spaces Used during MN LOE II

In theory, collaboration across security domains should provide a more robust, enhanced situational awareness. In this LOE, no statistical difference existed in participants' self-assessed situational awareness within the first two weeks, preventing meaningful comparisons about the effect of the cross-domain concept.

b) *COI 2.1 Findings*

(1) Finding 1 → Due to a variety of experimental factors, future MNIS was not exercised sufficiently.

When asked if nations shared information satisfactorily to develop a multinational ONA, SCDs commented that the exercise did not create conditions that sufficiently tested information sharing. More experimentation is required to fully answer this question.

Even though the working relationships improved over time, SCDs said, "We don't know the answer to this question. The injects didn't seem to be pertinent or valuable enough for people to absolutely need them to make good decisions. We also didn't form the circumstances in which people in coalitions had vested personal or national interests—the two key variables for precluding or sharing information. Suggest we derive ways to make certain we are perturbing these two variables for the next LOE."

Asked if the future MNIS was an improvement over current methods, SCDs said that the difference was unclear: "[It] appears more likely that the learning curve, increased familiarity with other players, and the transition to a 'matrix' collaboration process [versus] traditional staffing had far more effect on the sharing outcomes." SCDs also noted that relationships among players had been built up, resulting in increased trust—a "critical factor in the improvement in information sharing," more so than the new MNIS method.

An underlying problem was that the experiment did not use information sharing as originally planned. During Week 1, observers noted that participants truncated national disclosure procedures, resulting in no practical difference between the current information sharing procedures and those of future information sharing. In addition, the injects that participants received at the beginning of each vignette were created before the CISP3 convened, so that CISP3 decisions did not affect many of the disclosures. Further, to reduce the administrative burden on SoSAs and planners, all nations' panels decided to list exceptions to automatic release rather than to develop explicit items for automatic release. This may have influenced the employment of the future information sharing to reflect that of current information sharing.

Finally, insufficient time was allowed to complete the experiment's ambitious agenda. Non-real-time injects hampered the foreign disclosure officers' (FDO) work. The recommended solution was to extend time for the FDO to work through the releasability process and for each nation to digest the newly released information. Additionally, competing experiment objectives, such as conducting basic collaboration among distributed nations, took precedence over the more advanced goals of information sharing.

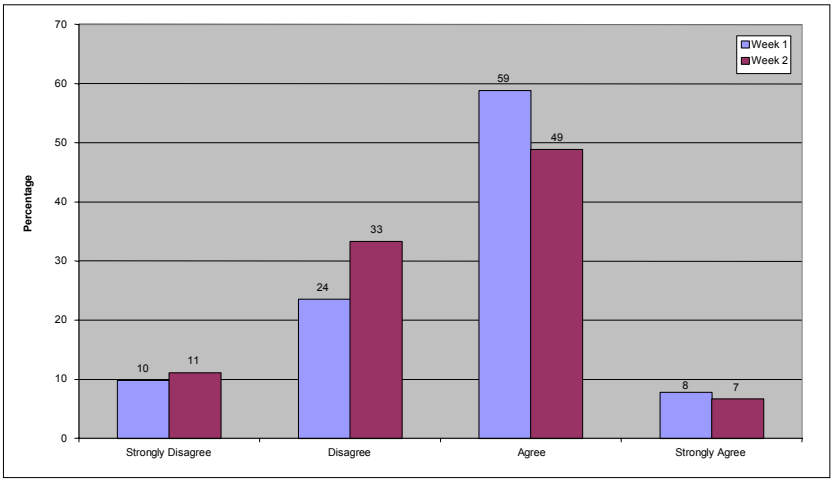

Figure 15. Information sharing across security domains enhanced the quality of information in the ONA knowledge base.

(2) Finding 2 → Information sharing across security domains enhanced the ONA quality.

Regarding information sharing, positive comments from respondents indicated that "something is always better than nothing." When an information-sharing database is implemented, participants will work to improve it continually. Specifically, interactions must be managed to foster collaboration. A Canadian participant observed, "For the purposes of LOE, this is an effective test. It worked, and info was often used for the construction and selection of nodes, effects, actions, and resources." Even though participants indicated that the ONA knowledge base was enhanced, they also indicated that the MNIS was not sufficiently tested. (See Figure 15.) Information was not shared across real-world security domains in this experiment; all information was notional, unclassified, and for official use only.

A majority of the players indicated that needed information was available in the ONA knowledge base during both weeks of the experiment. (See Figure 16.) Players indicated that the database was sufficient within the context of the experiment. However, the database still needs substantial work before it becomes viable as a real-life decision-making tool, as this Canadian participant observed:

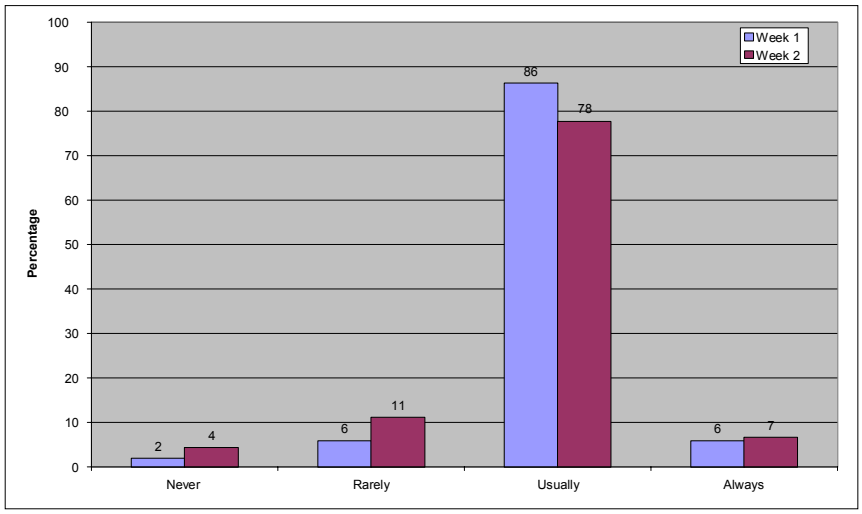

Figure 16. The ONA knowledge base contained the information needed.

> "The nodes were fairly comprehensive for the two countries. Effects were the next most comprehensive component. The actions and resources were poorly populated (qualitatively and quantitatively), in the following senses: Actions list was lacking some actions, which would have been blatantly obvious (for example, ministerial-level engagement, MNC engagement). Resources list was heavily populated with military assets, which in Week 1's scenarios were not useful. The focus this week was on pre-crisis, no hostilities situations, and that 80 percent of the resources seemed to be hard military assets seemed inappropriate. In this week's situations, resources such as multinational councils, individuals within other partners' countries, and a variety of governmental officials were found to be the most useful resources for the ENAR linkages that were discussed. These resources were also added as the need arose. There is an important need for nontraditional

resources to be included in this list if we are truly to consider diplomatic, and nonhard military approaches to these situations."

Most significantly, no statistical difference existed from Week 1 to Week 2 in the players' perceptions of the degree to which information-sharing procedures allowed the sharing of information during the ONA development process. The capability to communicate instantly with other countries and to collaborate from a common database is invaluable. However, the information-sharing procedures used within the experiment were not effective, according to participants' perceptions. Many commented that the large, cumbersome information-exchange requirements list created confusion and took an exorbitant amount of time to get through.

(3) Finding 3 → Smaller groups were more conducive to collaboration than were the larger groups.

Collaboration among nations across the information-sharing spaces led to discussions about sharing information more efficiently. As an attempt to increase multinational collaboration within the constraints of the collaborative technology, the coalition agreed to break into small groups organized by PMESII (analysts') and DIME (planners') areas toward the end of the second week. Nations were assigned to moderate these group efforts to link effects, nodes, actions, and re-sources. These small groups fostered better co-llaboration, better information sharing, and increased partici-pation among the coalition nations. Regarding facilita-tion, some nations preferred full consensus to majority rule.

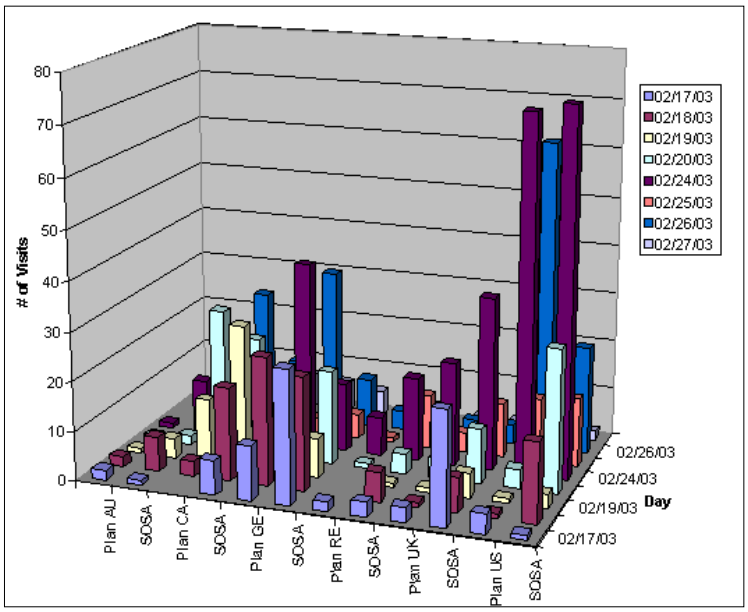

Figure 17. Discussion Tool Usage during MN LOE II

As depicted in Figure 17, discussion tool usage increased on the days that smaller groups were used. The use of Internet Protocol phones caused one spike on February 24.

(4) Finding 4 → No significant statistical difference in situational awareness occurred from Week 1 to Week 2 of the experiment.

As one of its objectives, the experiment evaluated the effect of the information-sharing mechanisms on situational awareness, using a comparison of Weeks 1 and 2.

Figure 18 shows the total probe performance for Week 1, when traditional information sharing procedures were used, and for Week 2, when the new CISP3 "future" information sharing mechanism was applied.

The data suggests no significant difference in the players' abilities to answer the probe statements in Week 1 and Week 2, probably because of similar information-sharing mechanisms used during the period. As for information sharing itself, during Week 2, players more rigorously scrutinized intelligence products and therefore reduced the amount of information disclosed. This unplanned, unanticipated part of the experiment developed as each nation made increasingly realistic information disclosures over time.

As shown in Figure 19, probe questions included inject- and background-based material, with a marginal difference in the interaction between type of probe—"distracters" and "injects"—and information-sharing mechanism. The data suggests that the slight, statistically insignificant deterioration in probe performance from Week 1 to Week 2 is due not to inject-based material, but to background information, or distracters. Fewer correct answers were based on background material, possibly because players did not read or pay as much attention to the background material in Week 2 as they did in Week 1. Players commented that the background

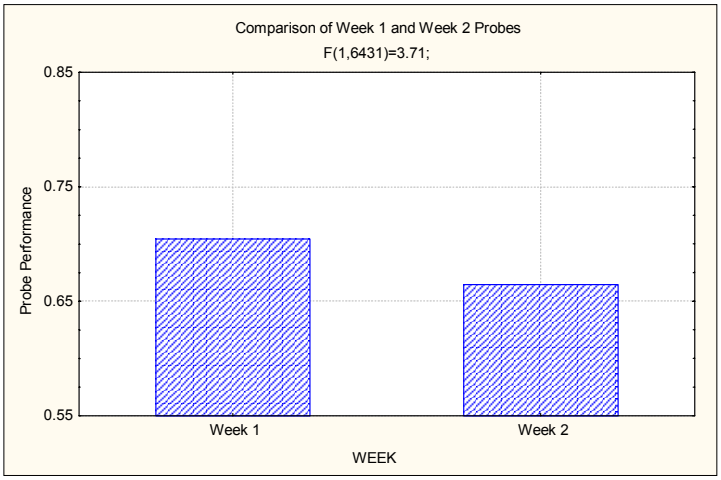

Figure 18. Probe Performance for Week 1 (Current Information Sharing) and Week 2 (Future Information Sharing)

Figure 19. Probe Performance by Weeks 1 and 2 and by Type of Probe Questions

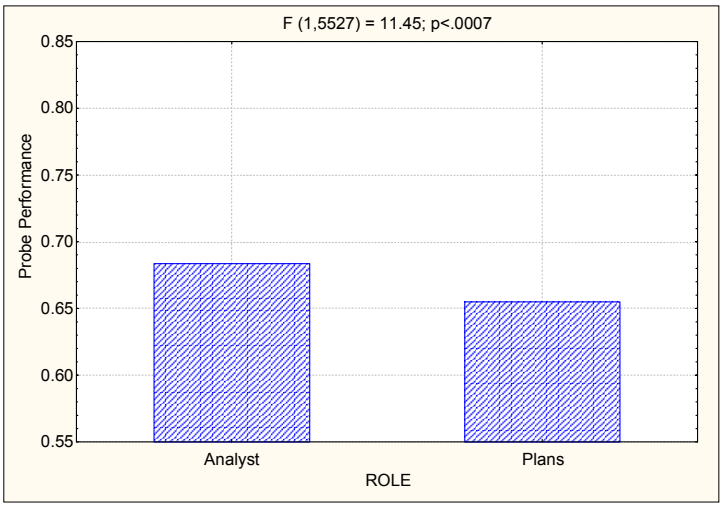

Figure 20. Probe Performance by Role of Player

material to the vignettes was relevant only for answering the probe questions and not for play, and consequently, they stopped bothering with it.

Probe Performance and Role

As depicted in Figure 20, probe performance by role of player was examined to determine the difference in situational awareness. Al-though no difference was observed from one week to the next, differences within each week were found between planners and SoSAs. The data suggests that the analysts were better able to answer the probe statements than the planners were, probably because they knew more about the inject material. Planners may have had a better general overview of the injects and of the general situation, but were less able to discern the fine detail required in the probes.

Self-Assessed Situational Awareness

Participants' self-assessed situational awareness complemented the actual probe performance, showing no significant statistical difference from the beginning to the end of the experiment. (See Figures 21 and 22.) Situational awareness appeared to be average across the board, although the large amount of data was difficult to maintain. Participants' familiarity with the tools and their functionality also affected their assessments: "The way you have to navigate around Groove and the undisciplined manner we are moving and sharing the info make it hard to be comfortable with what you should know." To familiarize them with the probe process, participants answered questions during Week 0 about situational awareness for the overall experiment construct. Figure 22 presents that data as a baseline for the experiment weeks.

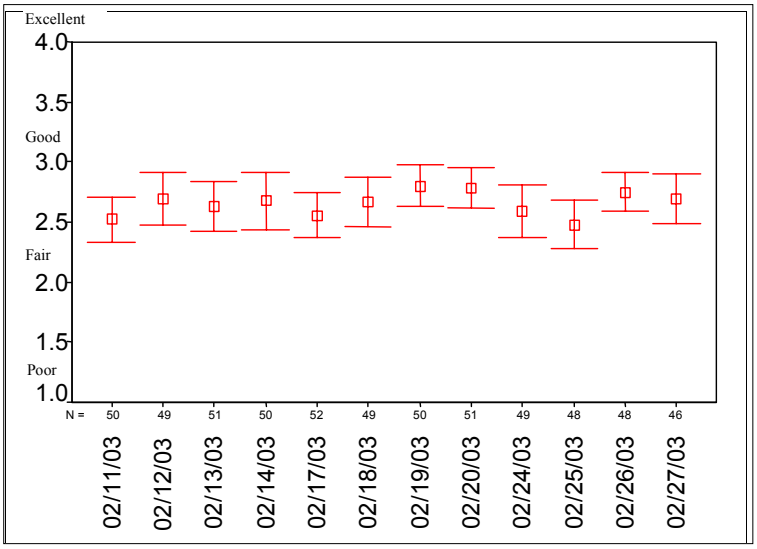

Figure 21. Mean Rating of Overall Situational Awareness

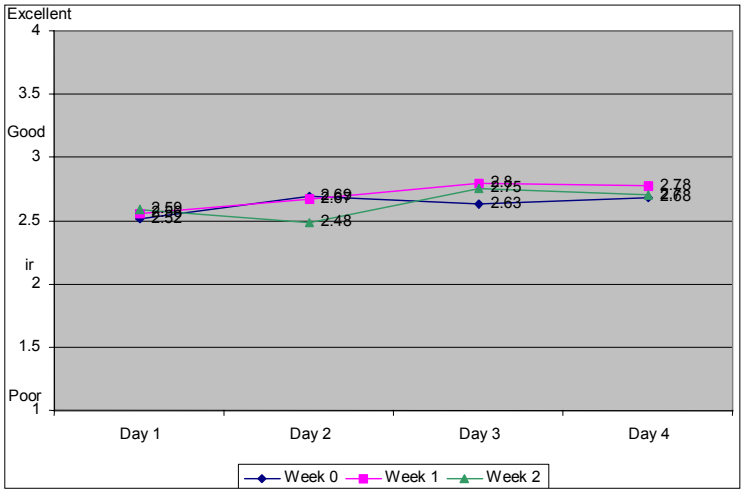

Figure 22. Players Perceived SA Week 0 through 2

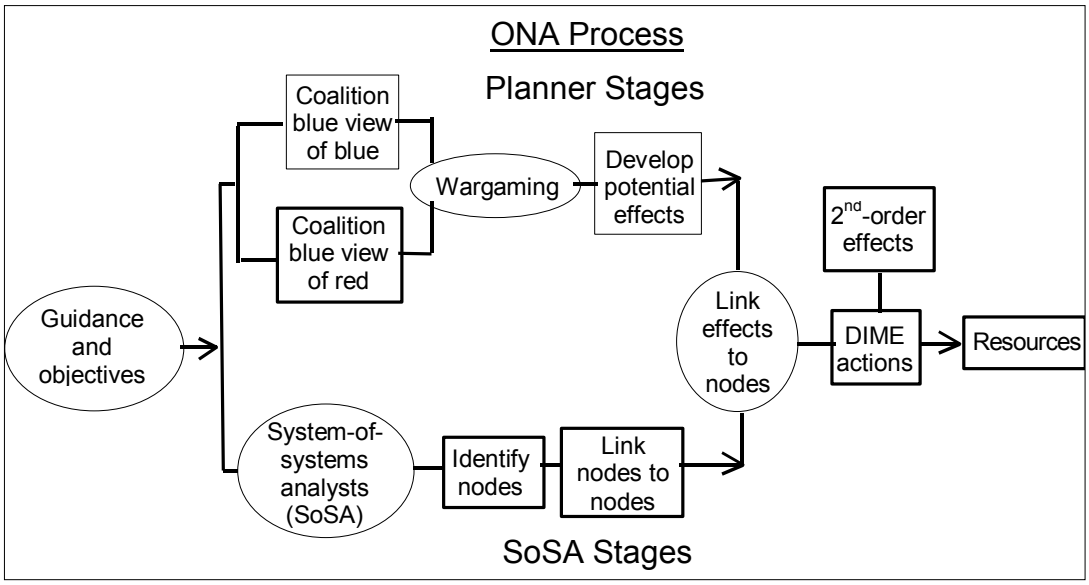

Figure 23. Depiction of the ONA Process

(5) Finding 5 → Releasability violations decreased as familiarity with the functionality of the tools in the collaborative environment increased.

This area of assessment was a direct result of the artificiality built into the experiment. Participants were directed to report all violations, all of which resulted from unfamiliarity with the tools and the experiment construct. Reported releasability violations decreased from Week 1 to Week 2. Nineteen distinct violations were reported during Week 1, plus 22 duplicate reports. Eight violations were reported during Week 2. Based on players' and observers' comments, this significant decrease was due more to an increased comfort level with the tools than with the differences in information-sharing methods. In the future, a more structured training regime should be used before a similar database is used.

The releasability problems encountered were related to human error and to the familiarity or comfort level in using the tools. Most inadvertent releases resulted from a participant's misunderstanding of sharing rules or from incorrect assumptions about the "buttonology" in the ONA database. Information-sharing violations will occur in the real world, as well, due to operator error, technical glitches, and operator training deficiencies.

(6) Finding 6 → More in-depth collaboration resulted from familiarity with the tools and fellow participants; from the increased use of moderators; from organization into smaller, structured groups; and from the refinement of business rules.

Players, controllers, and observers alike commented that the use of moderators or facilitators improved the process. Senior concept developers also addressed this issue during the azimuth and in-focus sessions. A more structured leadership style is needed within a collaborative environment to organize efforts and to focus on objectives. Refined business rules also provided structure to the collaborative process.

Throughout the experiment, players collaborated more as they became more familiar with Groove capabilities, with ONA database tools, and with each other in this "virtual" environment, which increased their comfort levels. Senior concept developers recommended that the leaders personally meet each other and work together during the pre-experiment workups.

In comments echoed by each participating nation, an American controller summed up the effect of smaller groups on the collaboration process: "Small groups in functional disciplines (all 'P' of PMESII together) collaborated better than large gaggles where most people remained silent on the line … If the goal is to produce maximum collaboration, then do it via smaller [multinational] teams. If you are in the crisis mode, do it via [multinational] teams only to build the consensus you need for [multinational] operations."

3. COI 2.2 Discussion – What impact does information sharing have on each phase of the ONA process?

a) *COI 2.2 Assessment Results*

MN LOE II was conducted as a series of related events—three workshops followed by the time-constrained experiment. The workshops were used to train players in the ONA process and to conduct the earlier phases of the process—red-and-blue views and wargaming. The experiment focused on the later phases—effects, nodes, actions, resources, and their linkages—but insufficient time remained to play the last phase, second-and-third-order effects.

Information sharing had little effect on any of the phases of the ONA process. By design, information sharing was not attempted during the workshops. But even during the experiment, information sharing was rarely emphasized, since an under-developed CISP3 concept meant that current and future procedures were similar. The last two phases received little experiment emphasis or were not played at all. Figure 23 depicts the ONA process.

b) *COI 2.2 Findings*

(1) Finding 1 → Information sharing did not affect the development of red and blue views or of wargaming because they were not played during the experiment.

The red/blue views and wargaming phases were conducted during the workshops, where players learned the ONA process. The workshops did not employ the collaborative tool, and discussions about red/blue views and wargaming occurred using presentations in meeting rooms, intentionally without the experiment's information-sharing mechanisms. To save time, these phases would not be revisited after the workshops.

Some players' and controllers' survey comments indicated that the red/blue view was not played during the experiment. Players said that they thought that the red/blue view and wargaming processes never were followed and that no discussion of red/blue capabilities, vulnerabilities, and intentions occurred. Some players did not know if they were supposed to be wargaming. Players also said that information-sharing procedures were not implemented, and that time did not allow real-world strategic planning with long-term impacts. They did not get into the wargaming process enough to "draw out" national perspectives. All information was unrestricted and from open sources during development of these phases. Players held no "nonreleasable" information that would have altered coalition views as developed in this exercise.

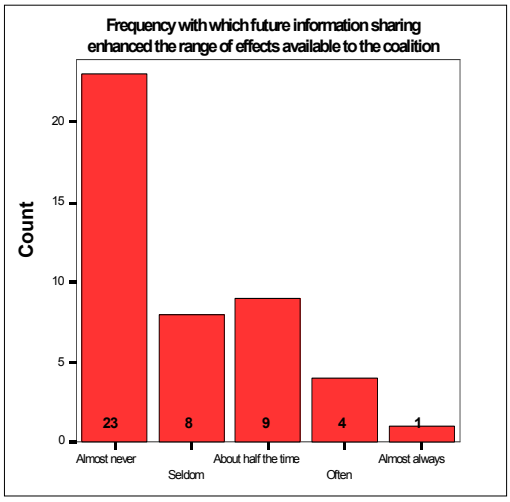

Figure 24. Information sharing did not influence the effects phase.

Certain groups of players emphasized that wargaming was a critical part of the ONA process, when issues related to other phases could be discussed. Subsequently, the U.S. planner pointedly incorporated wargaming into the business rules for ONA procedures. In reality, wargaming as a deliberation process consumed too much experiment time and had to be curtailed in order to pursue development of procedures for effects, actions, and resources—the experiment's designed focus.

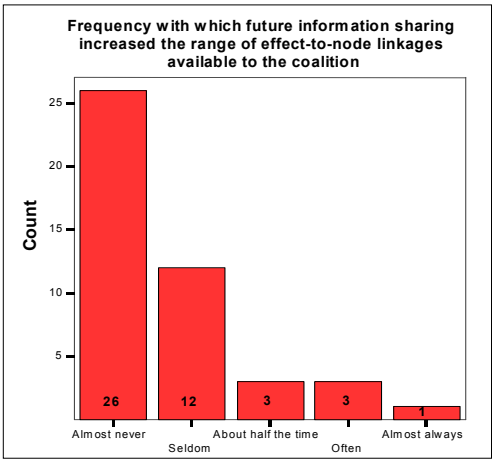

Figure 25. Information sharing did not influence effect-to-node linkages.

(2) Finding 2 → Future information sharing had no influence on the effects, nodes, actions, and resources phases of the ONA process.

Because of time constraints, the experiment focused on the development of effects, nodes, actions, and their linkages. However, information sharing rarely affected these phases. When players and controllers were asked how frequently future information sharing enhanced the range of options available to the coalition for a particular phase, the predominant response was "almost never." (See Figures 24, 25, and 26.) Survey comments consistently made these points:

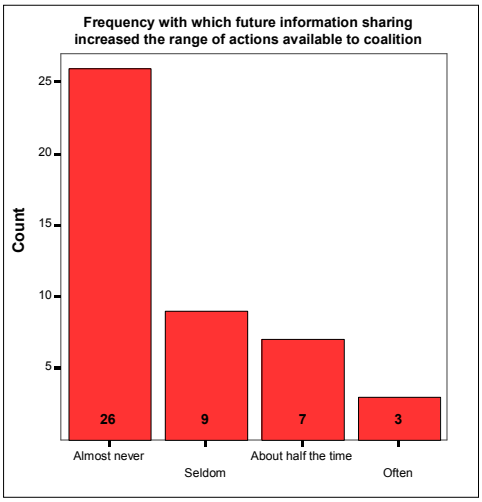

Figure 26. Information sharing did not affect the Action Stage.

- Information-sharing rules based on the CISP3 concept need more refinement and experimentation.
- Information sharing rarely had sufficient emphasis to affect these phases.
- No significant change occurred from current to future information sharing.

(3) Finding 3 → Information sharing did not affect resources or second- and third-order effects during MN LOE II.

Since resources and second- and third-order effects were expected to receive minimal play during the experiment, experiment designers did not emphasize them. Actions had priority consideration over generic, high-level resources. The ONA process did not progress to second- and third-order effects during the experiment.

Resources were debated more than expected during player collaboration, but information sharing was not included. Survey results revealed that sources of disagreement among nations included nodes, actions, and resources. Players did not mention information sharing in connection with resource development because it was not stressed in the experiment or because they did not recognize its relevance.

As predicted, second- and third-order effects were rarely addressed during the experiment, and so the influence of information sharing was not observed.

4. COI 2.3 Discussion – Does the MNIS future operational concept accelerate the ONA process?

a) *COI 2.3 Assessment Results*

Since the CISP3 process was not adequately defined nor implemented to protect classified material, the MNIS concept was tested only marginally in this experiment. The ONA process was not proven to be faster; more empirical testing is needed. Continued efforts must occur to further develop the MNIS concept, whose inherent value lies in its potential to improve the speed at which the ONA database is built. Future technological advances and synchronization tools may provide essential support to this process.

In principle, the involvement of several nations and the subsequent coordination required may slow the decision-making process. In peacetime, the quality of the results increases when more partners are involved. But in a crisis, stringent time limits determine the required speed of decision-making. The possibility of real-time sharing of information offers a substantial advantage. Such an exchange will accelerate greatly the development of a common knowledge base, and at the same time, will enhance the quality of the information shared.

b) *COI 2.3 Findings*

(1) Finding 1 → MNIS supported the construction of an ONA database, but no difference was determined between MNIS "as is" and "future" processes.

Additional CISP3 information exchange requirement categories to cover blue force information, as well as an overall streamlined information exchange requirement list, may speed parts of the ONA process. With the additional training benefit gained from the work performed during the first week, the FDOs handled only a couple of injects at a time and responded quickly to requests to release information. But the need to collaborate with multiple nations actually may lengthen the time required to build the ONA, whereas a U.S.-only ONA could be built more quickly.

Additional observations from all nations showed no discernable difference in the information sharing and collaboration. Furthermore, no statistical difference existed among effects, actions, and resources data records available in the ONA knowledge base. As Figure 27 shows, equal numbers of effects, actions, and resources were created and made available to participants throughout the entire experiment.

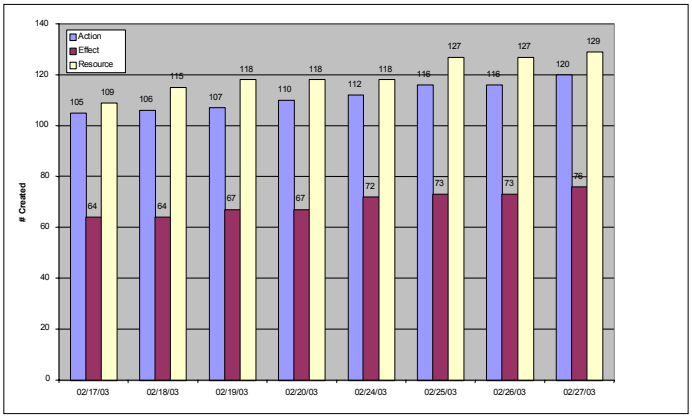

Figure 27. Effects–Actions–Resources Created versus Time

Similarly, the number of node data records available in the ONA knowledge base did not significantly differ from Week 1 to Week 2. (See Figure 28.) The slight change seen during the last few days of Week 2 may have been due to experiment design changes, such as working within DIME or PMESII groups, rather than to information-sharing methods.

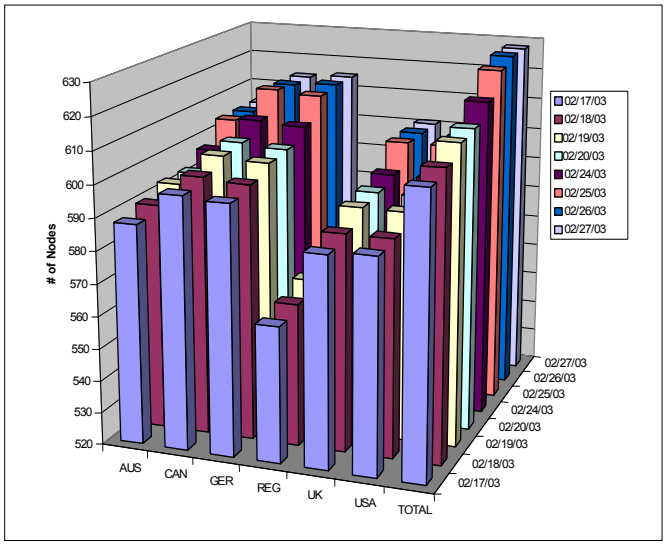

Figure 28. Number of Node Data Records Available

The number of node data records available directly reflects the spaces that a country may visit. All member nations were members of the coalition spaces and the private spaces. Germany and Canada were members of the multilateral and trilateral spaces; the United States and the United Kingdom were members of the multilateral and bilateral 1

spaces. More node data records were available in the trilateral space than in the bilateral 1 space. A similar comparison may be made between Australia and the regional cell.

(2) Finding 2 → No conclusive test determined that MNIS accelerated the ONA process. MNIS concepts need further development.

During the final hot wash participants within the regional cell reflected that they could not determine whether the process had accelerated. The regional cell conducted multinational information sharing, but when the requirements for automatic release were not clearly met, review and discussion reverted to normal procedures.

The Canadians' final hot-wash comments concluded that the ability to move quickly through the ONA process was not determined exclusively by information-sharing rules; information availability and analysis time constraints also were factors.

Observers, participants, and a SCD suggested that the process could be accelerated through information sharing and direct communication. The more subjective the information, the more directly it must be communicated.

As depicted in Figure 29, most players, observers, and controllers agreed that Week 2's information-sharing procedures did not accelerate the ONA process:

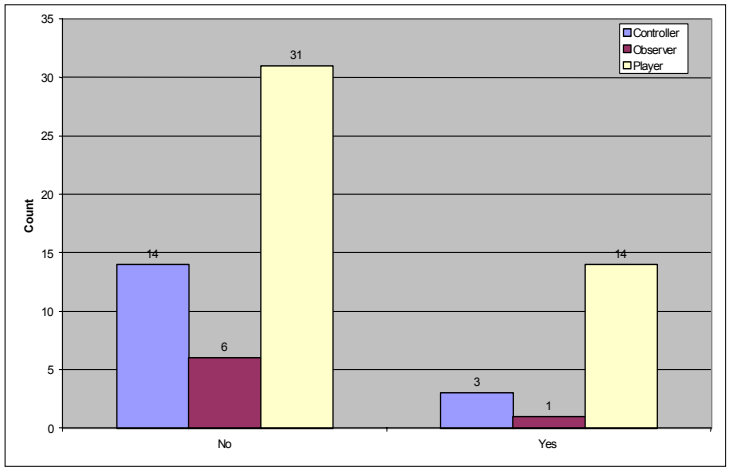

Figure 29. Did Week 2's information-sharing procedures accelerate the ONA process?

- "The only speed enhancements were as a result of changes in experimental procedures, players' familiarity with the tools, and anticipation of ENDEX."
- "Did not see that there were really any differences in the information-sharing process from Week 1 to Week 2 (although there [were] supposed to be)."
- "Still worked in three spaces (COA, ML, TL), due to injects coming in to each of them."
- "It may have [accelerated the ONA process] in the real world, but in the experiment environment, there was too much that we did not replicate; for example, national FDOs were considered the originating authority for all messages. Using the white cell would have been a better choice."
- "Here's an example of the 'effectiveness' of CISP3. Four injects were received for vignette #4, one of which had a red banner at the top advertising that it was not releasable to the COA without going through the CISP3 process; the other three

had no such banner. However, only one of the four could be released without going through the CISP3 process."

- "But it was entirely artificial. We could make it as fast as we wanted."
- "It took more time for discussion of the issues that 'failed' the automatic release test. Those that passed through the screen automatically probably would have been passed along quickly without the use of the matrix."
- "No, but level of quality was increasing."
- "No. Did not observe any appreciable difference in the ONA process between Weeks 1 and 2 [that was] attributable to information sharing."
- "CISP3 was unworkable."

5. COI 2.4 Discussion – Can information releasability procedures keep the ONA data current?

a) *COI 2.4 Assessment Results*

Most participants agreed that information release procedures implemented in this experiment kept the ONA data current. However, they also noted that those procedures would be extremely difficult to implement in the real world. Due to the small amount of data that needed to be updated in the database during the course of the experiment, participants cautioned against concluding that these procedures would be effective in an operational environment.

b) *COI 2.4 Findings*

(1) Finding 1 → Information release procedures potentially may affect the currency of information needed to conduct a successful multinational ONA.

In the real world, keeping the database current is a challenge, and release procedures would definitely have an impact on the quality of the database.

As Figure 30 depicts, players found minimal correlation in this experiment between releasability procedures and the currency of the knowledge base. Each vignette lasted only two days, and the few information injects, provided at the beginning, allowed the ONA database to be updated easily. Even so, updates were not always posted as soon as they were made available and so were a secondary consideration. After those injects were shared, no basis existed to determine the currency of the database.

(2) Finding 2 → Participants identified issues that inhibited their ability to keep the database current.

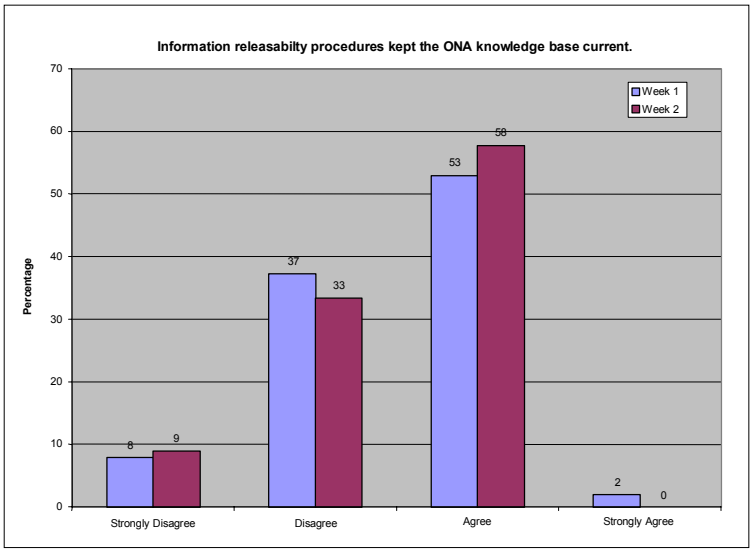

Figure 30. Perception of Impact of Information-Sharing Procedures on Currency of ONA

Release procedures potentially may inhibit keeping the ONA current, but they are not going to "go away." In addition, national policies often inhibit release of information and database currency. Because the CISP3 was not exercised extensively during Week 2, its potential to facilitate the currency of the database was not assessed.

(3) Finding 3 → Participants identified release procedures that facilitated their ability to keep the database current.

U.S. participants who were familiar with the FDO process benefited from the FDO discussion of releasability issues. Intuitively, fewer release restrictions meant a more effective flow of information. Yet, business rules, specific information-sharing domains, and releasability procedures were useful. Multilevel releases allowed information to reach a wider audience, even if not the full coalition area. In addition, the process was facilitated by prompt action, discussion, and interaction between the players and CISP3 to resolve issues, as well as by national foreign disclosure procedures.

C. SPIN-OFF FINDINGS

A result of the discovery nature of the experiment and the data collection process, these analytical findings are based outside the realm of the examined objectives and COIs.

1. Spin-Off Findings Assessment Results

Finding 1 → At times conducted asynchronously, the continuous ONA process should be performed with minimum distinction between the methods and release/disclosure policies that are used during and before a crisis situation.

Built on a knowledge base, ONA is a continuous process that requires continuous collaboration, which allows leaders to make good, fast, effective decisions. Using analysts' expertise, the value of existing knowledge is based on its relevancy to the situation. In addition, analysts "create" knowledge through a lengthy process of data collection and effective collaboration. Differing policies for crisis and pre-crisis release or

disclosure may impede timely access to critical information. Effective ONA depends on successful information sharing in a pre-crisis situation.

Finding 2 → Partner nations strongly favored political agreements as well as a legal basis to establish and conduct the collaborative ONA information-sharing process.

Partner militaries must operate under political and legal controls that differ from those of the U.S. These approved agreements would give shape and legitimacy to the ONA process.

Finding 3 → ONA database capabilities must be improved to support the ONA process.

Participants' comments and observations indicated that, within the context of this limited-objective experiment, the ONA database adequately supported the experiment objectives. Furthermore, as Figure 31 shows, a significant number of respondents indicated that the tools used allowed easy search and access, in spite of some limitations. Participants indicated that improvements to the ONA database are needed in order for it to support adequately a real-world multinational ONA process. Suggested improvements included:

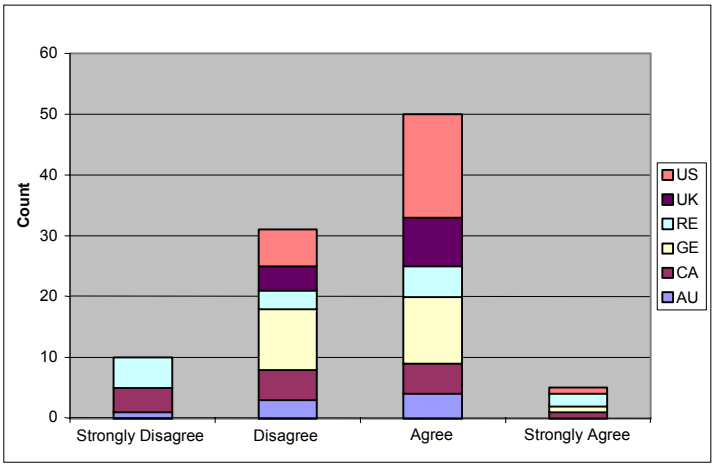

Figure 31. Users indicate that tools allowed easy search and access.

- Query response times
- Advanced database filters, sorting and search capabilities
- User selectable tracking and/or notification of database updates and changes
- Priority and hierarchy associations with linkages and effect
- Easier navigation through the database among nodes, effects, and linkages
- Support for the constant back-and-forth among nodes, effects, and various displays that is required in the cognitive process of ONA
- Tagging of records with reliability, confidence, and date of information
- Simultaneous use of different parts of the database without needing to open more collaborative tool workspaces
- Collaborative work on the database
- Tools to assist in the collaborative data-review process
- Enhanced graphical displays of data, including three-dimensional visualization
- Creation of links in the graphic display
- Internet access.

Finding 4 → To transform information into shared knowledge, information sharing must be assessed and evaluated.

To accomplish this transformation, every document to be shared should contain the rationale for information sharing. Since knowledge is represented in the ONA database through nodes and their linkages or through inserts to the effect, actions, and resources lists, the document originator should include the effect of this information on the database. This would accelerate staff processing efforts to identify the addressee and would support multilateral collaboration by helping the receiver to assess the proposal. The originator's assessment also should address the action needed within the ONA database and effect on the effect, node, action, or resource.

Finding 5 → To keep track of shared information, a data documentation system must be incorporated into the collaboration tool used during the ONA process.

This documentation system should store every incoming message by time and originator. Staff processing of the document, like evaluation and assessment, should be recorded in the information file. To support shared knowledge, the document system also should insist that the team member add his assessment and proposed categorization of this information.

Finding 6 → The collaboration tool suite must provide robust audio, text, and visualization capabilities to support a distributed collaboration.

The tool suite used must effectively facilitate multinational collaboration. The tools used for this experiment had many shortcomings that inhibited effective coalition collaboration. Most participants blamed the collaborative tool specifically, while others pointed to inadequate bandwidth allocated on the CFBL net.

Participants commented that some collaboration tool functions that were not available in this experiment must be implemented to support a real-world multinational ONA process, including:

- Robust audio capabilities
- Video teleconferencing
- Accommodation of numerous users in the same collaborative workspace
- Auditorium function for presentation of briefings
- More open workspaces, without a resulting application or network crash
- Broadcast feature within collaborative environment to pass information to all participants, regardless of workspace
- Audio controller to allow operator to open multiple workspaces and to select appropriate audio
- Enhanced ability to track text chat during audio chat
- Indication of the last message read in text chat

- Shared view of an individual's displays and products
- View of names of all message recipients
- Shared graphic products, pictures, and briefs
- Enhanced threaded discussions
- Enhanced whiteboard/sketchpad functions
- Enhanced automated change/update notification subscription functions
- Online reference documents.

V. EXPERIMENTAL PROCESS LESSONS

Many assessments and lessons learned are documented and published as a result of the success of MN LOE II. A mixture of lessons learned, comments, observations, and recommendations offered healthy, constructive criticism of the experiment. Input was critically reviewed in order to focus on the main issues and to lend credence to the rest. Presented in a Joint Universal Lessons Learned format, the lessons learned are not analytical DOTMLPF insights or recommendations, but rather offer suggestions to improve the experimental process.

The main lessons learned aimed to facilitate the successful completion of the next multinational experiment. After those lessons are implemented, or possibly at the same time, the ancillary lessons learned should be implemented if time and resources permit. See Appendix H for more information.

Lessons learned are presented in this format:

Title of Lesson Learned:

- Observation: This is the point of concern.
- Discussion: The discussion explains the observation and provides more background of the potential problem or solution.
- Lessons Learned: What was learned from the observation that was made?
- Recommendation: What is the recommendation for future experimentation?

1. Title: Better-Defined Experiment Objectives and Issues To Be Explored or Assessed

- Observation: Clearly defined experiment objectives are crucial to concept developers and experiment analysts. Hindsight revealed that some of the COIs had multiple meanings.
- Discussion: Sufficient focus is needed on a realistic number of objectives, given the limited available experiment time. These objectives must be identified, clearly defined, and articulated early in the planning process. The distinction between discovery and hypothesis testing must be considered in the experiment design. COIs must be succinct enough to allow the appropriate measures of effectiveness and performance to be identified. Implied objectives, such as training, must be clearly addressed to the experiment audience. Daily player objectives must be stated at the start of each day; is today's focus on process or product? This problem developed because experiment analysts were not intimately involved with all stages of the planning process, starting with the pre-concept development conference. The core MN LOE II analysts met after the initial planning conference; some joined during the mid-planning conference or later. Plans for MNE III include attendance of experiment analysts at the concept development conference.

Experiment analysts will conduct workshop-type meetings in conjunction with the planning events.

- Lessons Learned: All objectives should be identified, clearly defined, and articulated early in the planning process, with experiment analysts intimately involved at every stage in this planning process.
- Recommendation: Identify, clearly define, and articulate experiment objectives for MNE III now, with the experiment analysts directly involved.

2. Title: Experiment Planning and Design Involvement

- Observation: Some of the experiment concept experts were not involved in experiment planning until late in the process; experiment analysts became fully involved in experiment planning during the mid-planning conference. At that point, they could affect the experiment design only minimally.
- Discussion: Concept developers from all of the concepts to be evaluated must be directly involved early in the planning process. They must define their concepts so that the experiment planners and analysts may design the experiment to collect the data needed to examine them.

  Manning limitations and commitments to other experimentation events precluded most experiment analysts from becoming fully involved in the planning process prior to the mid-planning conference. Experiment analyst involvement is needed to ensure that the experiment design allows data collection and assessment to address the experimentation objectives.
- Lessons Learned: Experiment analysts and concept developers must be intimately involved in the experiment planning and design process at the earliest possible opportunity.
- Recommendation: Involve experiment analysts and concept developers in the experiment planning and design process from the initiation of the concept development conference through experiment execution. Furthermore, the planning events must include time for all partner nation experiment analysts to build assessment plans in conjunction with the workshops.

3. Title: Changes to Experiment Design During Execution

- Observation: Changes were made to procedures, database interfaces, and use of Groove spaces during experiment play.
- Discussion: A strong effort was made during MN LOE II to coordinate all changes through the lead experiment analyst. Pros and cons were weighed on the consequences of such changes, i.e., particular shifts would cause a paradigm change from hypothesis testing to a discovery type of experiment. In the long run, the shift to discovery was determined to be more beneficial in this particular LOE. The benefits of using discovery methods outweighed the limitations, such as limits to the analysts' ability to compare results from one vignette to another and from the first experiment week to the second.

- Lessons Learned: During future experiments, all changes must continue to be coordinated. Before implementing changes, future experiment managers must understand the potential implications and effects on experiment analysis. Uncontrolled changes to experiment conduct preclude the ability to test experiment hypotheses. If the experiment goal is discovery—not hypothesis testing—then greater latitude exists for making changes.
- Recommendation: Experiment managers should continue to coordinate proposed changes in experiment design with the experiment analysts and partner nations before allowing such changes to be implemented. Affected participants may need to be notified of those changes when the decision is made to implement them.

4. Title: Time Constraints

- Observation: Insufficient time was allowed to complete training and to explore key issues of the experiment.
- Discussion: Many problems stemmed from lack of time or misused time. It is impractical for experiments to last for longer than three weeks when experiment planners must squeeze in a final training week before two weeks of experiment play. Even though planners extended MN LOE II through workshops and ad hoc events to conduct portions of the experiment as well as initial player training, MN LOE II still ran out of time. No time translated into an inability to explore prime experiment questions, such as the discovery of multinational issues associated with different national perspectives. Here, players had insufficient time to debate national viewpoints regarding ONA viability during ONA development. Instead, time was used during the experiment to develop ONA process procedures, which could have been accomplished before the experiment and refined during the training week in a much-needed rehearsal walkthrough. But the training week was spent repeating basic training on tools and concepts for late-arriving players. The experiment was designed to examine the ONA process, not to generate products. This was stated clearly throughout the planning process. However, during execution, some participants were more interested in producing products than in working the process. This, along with overly ambitious experiment objectives, caused some significant time-related problems. Time constraints seen were directly correlated to the factor that In addition, the player list was unstable right up to the beginning of the experiment, causing additional repetitive training and subsequent time constraints.
- Lessons Learned: Limit objectives by the amount of time available to examine them. Make time a more significant factor in experiment planning. Also, identify the experiment audience prior to the experiment, and ensure that they are available for all training.
- Recommendation: Time management issues must be considered during experiment planning to ensure that experiment objectives and issues are addressed. Develop a more definitive timeline of experiment events tied to

experiment objectives. A mechanism is needed to make time available for issue exploration that does not constrain progress toward insights, but that also terminates exploration when acceptable conclusions are reached. Identify the experiment audience as early as possible, and ensure that they attend all training.

5. Title: Training without Practice Walkthrough

- Observation: Because no training vignette occurred, players perceived that training was conducted piecemeal, without revealing how all the pieces fit together until late in the game.
- Discussion: After the experiment, players complained that they "needed a training vignette during training week that pulled everything together so they could learn how to perform unified tasks instead of disconnected steps." A training vignette was, in fact, considered and planned, but was discarded when the nations unexpectedly requested additional training/briefs. As a result, the first vignette was essentially on-the-job training, which precluded more issue exploration. In hindsight, a practice vignette would have revealed some previously invisible experimentation bugs.
- Most pre-experiment training for players focused on using the collaborative tool, the database, various other tools, the ONA concept, and the experiment scenario. This training was spread out over several months and then repeated during training week for the benefit of late arrivals. ONA process procedures were developed and training occurred during the experiment. Training in information-sharing procedures never occurred at all.
- Lessons Learned: A practice walkthrough is essential to make training meaningful and is inevitable before or during the experiment. A walkthrough reveals hidden problems prior to the experiment.
- Recommendation: Plan and allocate time for a full practice walkthrough to make training meaningful and to debug experiment methodology.

6. Title: Collaboration Concept of Operations (CONOPS) or Tactics, Techniques, and Procedures (TTP)

- Observation: The process of building an ONA in a multinational environment suffered without a concept of operations for collaboration.
- Discussion: Due to the absence of sound collaboration practices, participants' unstructured use of text chat, audio, discussion threads, file naming conventions, and file storage practices made information sharing more difficult than it should have been.
- Lesson Learned: Effective collaboration requires well-thought-out tool use. CONOPS and TTPs for collaboration are needed.
- Recommendation: Future experiment events will require more thought and consideration of collaboration, and CONOPS and TTPs should be developed for future collaboration events.

7. Title: Collaborative Experiment Planning Meetings

- Observation: Coordination meetings often lacked multinational participation during the experiment planning process because national LNOs had many obligations. Experiment analysts solved this problem through weekly collaborative sessions.
- Discussion: Planning meetings often did not include multinational representation because national LNOs had many obligations. Additionally, key individuals, groups, or their representatives were often absent. The experiment analysts solved this problem in a cost effective way by conducting mandatory weekly collaborative sessions via Groove and teleconference. All nations were intimately involved with the design of the experiment analysis plan. After the experiment, the multinational analysts, many of whom were experiment leads for their nations, emphasized the importance and benefits of these meetings and strongly recommended that the same be done for follow-on experiments.
- Lesson Learned: Collaborative meetings would encourage more in-depth multinational participation and would result in a more robust experiment. Partners' direct involvement with weekly planning meetings would reveal more of the experiment flaws earlier in the design process. The continued involvement of partner team leads during experiment planning is essential for immediate consideration and resolution of emerging issues, as well as for the prevention of oversights.
- Recommendation: Design experiment planning sessions around the use of a collaborative tool or a teleconference to allow all multinational experiment leads to be more directly involved with the planning process. Furthermore, require mandatory attendance at IPT meetings by all key U.S. participants or their representatives. To increase non-U.S. partners' involvement at other planning events, hold planning meetings at non-U.S.-based facilities, thus seeking greater involvement and commitment from multinational players.

8. Title: CFBL Net Bandwidth Needs Boost To Support Robust MN Experimentation

- Observation: Despite a lack of modeling-and-simulation support, the network barely was able to operate with existing bandwidth to CFBL net points of participation.
- Discussion: Robust experiments, complete with modeling-and-simulation support, can use up to 10 Mbps of bandwidth, based on past experimentation results. Existing bandwidth serving CFBL net points of participation is only 1.5 to 2.9 Mbps. If joint experimentation plans to experiment in a robust manner with multinational partners, then available bandwidth will need a marked boost.
- Lesson Learned: Robust experimentation with multinational partners will require a boost in bandwidth to CFBL net points of participation.
- Recommendation: Initiate actions to boost bandwidth at national points of participation.

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VI. CONCLUSION

Effects-based operations will define the future of joint military actions that depict advanced warfighting capabilities across the full spectrum of operations.[9] Integrated and holistic information synchronization is employed to view the adversary from a system-of-systems perspective. Using this approach, political, military, economic, social, infrastructure, and information (PMESII) elements are linked with diplomatic, information, military, and economic (DIME) actions and resources to improve our understanding of the adversary and to disseminate information to commanders—all to improve decision quality and to increase situational awareness.

Decision superiority is a critical component of Joint Vision 2020 that aims to achieve full spectrum dominance for U. S. military operations.[10] Technological advances that enable materiel development and artificial intelligence systems support this dominance. Yet the human element remains the nucleus of the command-and-control system and must be supported by an integrated information environment that is capable of fusing diverse and dynamic data points.

The future of U.S. military operations continues to involve multinational coalitions, whether for counter terrorism activities, peacekeeping, humanitarian actions, or warfighting operations. Using this coalition mindset, an alliance must be able to collect and integrate information elements to form a coherent knowledge capacity for decision-makers. This introduction of a distributed and collaborative information fusion and planning effort would be constrained by cultural and organizational challenges imposed by the coalition perspectives and military experiences.

MN LOE II, collaboratively developed by the participating nations and organizations, tested the ability of a multinational coalition to build and fuse information elements into an effects-based database. This process was conducted in a distributed collaborative environment using the operational net assessment (ONA), an effects-based tool. Experiment participants included Australia, Canada, Germany, the United Kingdom, the United States, NATO CDE, as well as active observers from France, the sixth MIC member nation in this experiment. With the exception of SACLANT, countries participated from their national experiment sites using collaborative information technology.

The ONA enables decision superiority. The system-of-systems analysis, which focuses on PMESII elements, uses collaboration technologies and subject-matter expertise

[9] U. S. Joint Forces Command. (2002). Toward a joint warfighting concept: Rapid Decisive Operations. Suffolk: J9 Joint Futures Lab.

[10] U. S. Joint Forces Command. (2002). Operational Net Assessment: A functional National defense construct. Suffolk: J9 Joint Futures Lab.

to provide decision-makers with a rapid and holistic view of the adversary's strengths and weaknesses, as well as coalition DIME resources, to affect the adversary. System-of-systems analysts and planners collaborate to build the ONA database by identifying fused PMESII effects, nodes, actions, and resources that provide superior knowledge to a decision-maker who projects elements of national power to achieve specific effects. Information development must be a dynamic process to keep pace with changing conditions, such as the election of a new president or the replacement of a diplomatic minister. The effects-based planning element, supported by the ONA, depends on linkages among nodes, actions, and resources to support a desired effect. This experiment examined coalition members' efforts to develop an ONA and to create linkages to support a commander's intent in a distributed collaborative setting.

Based on favorable results from MN LOE I & II, the future looks promising. The development of a coalition operational net assessment capability is highly relevant, as is further experimentation on information-sharing procedures in the multinational arena. All partners involved with MN LOE II considered a multinational ONA to be a powerful process that includes national perspectives and that uses the cultural synergy of collaboration. This experiment clearly demonstrated the stress that a commercial technology bears to support distributed collaboration when a large group of participants accesses and modifies a large ONA database. However, despite these technical difficulties, distributed collaboration effectively conducted ONA development.

Additionally, the ability to share information among coalition partners is essential, even in a pre-crisis situation. Multinational information sharing is key to building trust and confidence in a coalition. Furthermore, the investment in and use of the collaborative information environment must continue. The capability of the collaborative system used in an experiment and in the field should align with the functional requirements of the experiment participants or of the combatant command.

APPENDIX A. ANALYSIS WORKSHOP FEEDBACK

The experiment analyst workshop, March 24-28, 2003, in an extremely aggressive schedule, aimed to review all independent analysis completed by each partner nation analysis team and to prepare the MN LOE II Final Report. Each partner nation discussed lessons learned, as well as independent analysis of the COIs and objectives. Additionally, future analysis was addressed. The lead experiment analyst for each country planned:

- To present and discuss analytical results of MN LOE II
- To offer professional insight into partner nation assessments
- To show draft findings and lessons learned for the final report
- To work towards completing the final report.

The workshop was a success, and such sessions should be built into the experimentation process. The face-to-face meeting produced a superior exchange of information with ample discussions in a balanced atmosphere, and national representations resulted in an extremely productive working group. Many multinational experiment analysts independently examined the experiment and came up with corroborating results, lending credence to the MN LOE II Final Report. Furthermore, the multinational collaboration made the final report more than a U.S.-centric document.

Many lessons learned were addressed as a direct result of the workshop. See Section V and Appendix H for the entire compilation of lessons learned. In all future experiments, experiment analysts must work in conjunction with the experimentation design and planning. Also, the constant repetitiveness seen in MN LOE II must be avoided because it detracts from the main effort of analyzing the experiment.

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APPENDIX B. SCENARIO AND VIGNETTE DETAILS

The following annex contains information relating to the scenario ramp-up document and the four vignettes used during Multinational Limited Objective Experiment II. The ramp-up document was posted at the beginning of Week 1 in the Groove shared space for the coalition. At the start of each vignette's two-day experiment period, the vignette briefing and associated Word document also were posted in the coalition shared space.

A. ANNEX 1 TO APPENDIX B – SCENARIO RAMP-UP DOCUMENT

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(U) The World View in 2010

(U) In 2010, the world continues in an uneasy state of near-equilibrium, with indications of economic, political, and social stresses. The armed forces of the U.S. and its multinational allies continue to be stretched to react to potential flashpoints, as well as to the continuing global war on terrorism.

(U) The emerging global economic environment created new vulnerabilities for the national security of nations. Energy and resources continue to have major strategic influence as demand increases at a pace that exceeds availability, and the world's energy remains petroleum based. New technologies divide the world as well as unite it, simultaneously creating new vulnerabilities as they offer opportunities. All physical and virtual borders are more porous, some are bending, and some are breaking. Space is a critical and competitive military environment.

(U) The U.S. remains the premier global superpower, and with the European Union, Russia, China, and the U.N., they seek to maintain a peaceful world order. Although the U.S. has no peer-competitor with regard to the capabilities and means to execute sustained, global military operations, the European Union, China, and Russia can conduct short-duration military operations globally, unilaterally, or with only minimal assistance from allies. Within the past several years, both China and the European Union have expanded their capabilities to complement the huge technological lead of the U.S. military.

(U) On a global scale, unemployment is gradually improving, but a great disparity exists between the "haves" and "have-nots." Many nations view free trade and a global financial system as the optimal solution for improving their economies. Three major trading/economic blocs control the global economy—the U.S., the European Union, and Asia, largely China and Japan. In addition, India is emerging as a major global economic power.

(U) The emerging global economy includes much economic interaction, and markets are generally open. However, trade barriers, quotas, export restrictions, and occasionally sanctions remain, as many nations seek to guide their own economic recovery and to protect their own economies. Many nations and corporations engage in economic warfare, which is beginning to affect certain sectors of the recovering global economies. Global economic demands continue to push the limits of state-of-the-art information and technology systems, as competing businesses and organizations seek to gain and maintain the competitive edge.

(U) Tensions in 2010

(U) The world in 2010 holds many potential flashpoints: the Middle East, Kashmir, possible revolution in Venezuela, ethnic strife and terrorism that threaten the West African states, continuing terrorism and insurgency in the Caucasus, and the ever-present concerns

in the Persian Gulf. As the world economies continue to accentuate the differences in classes over the past decade, terrorism took root in more countries than ever before, and terrorists adopted high-technology tools to wage their asymmetric war.

(U) These sections summarize the significant events that have shaped the world, beginning with the supranational organizations and continuing in more detail to selected individual countries.

(U) The Supranational Organizations

(U) The U.N. gained greater relevance through its ongoing humanitarian relief and peace operations, gaining political leverage with numerous affected nations. Additionally, the U.N. had to come to grips with the increasing worldwide problem of internally displaced persons and refugees. The U.N. High Commissioner on Refugees (UNHCR) and the International Organization for Migration (IOM) exerted considerable influence in several cases of ethnic warfare. However, the U.N. is still affected by some degree of distrust, as well as the occasional "veto" wars in the U.N. Security Council.

(U) The European Union is evolving into an increasingly powerful body for Europe, ready to progress beyond a strictly economic entity with the advent of more political unanimity and a notional military self-defense pact. However, member-states still exercised sovereignty when it was in their best interests. The European Union attempted to challenge the U.S. economically as a peer competitor, but it remains hobbled by high labor and social costs.

(**U) Regions and states**

(U) Middle East. The Middle East remains unstable. Terrorism, especially by Muslim extremists, is widespread and is a major destabilizing factor. The region remains militarized, and military expenditures remain high. Intelligence analysts believe that more than one nation has nuclear weapons and the ballistic and cruise missiles to employ them. The U.S. continues to maintain a close political, economic, and military relationship with Israel.

(U) Caucasus. The insurgencies of the early 2000s have continued; however, in 2008, Russia reacted with a major show of force in the Caucasus and has had to essentially maintain an army of occupation ever since. The insurgents have created major problems in the region and have threatened the Trans-Caucasus pipelines. This has become a major issue for Russia and is occupying much of their leadership's attention. This has a spillover effect on the Russian oilfields in central Asia.

(U) Southwest Asia

(U) The U.S. is the dominant stabilizing external force in Southwest Asia and maintains a significant military presence there. The U.S. continues to provide political, economic, military, humanitarian, and other nation-building support to Iraq after successfully affecting the change of regime. Russia has exerted influence from the north, and China and Japan have both increased their presence there.

(U) Militant fundamentalists and terrorist organizations remain an active force in the region. Yemen has resurfaced as a center of terrorist activity.

(U) Africa

(U) Several states in Africa have virtually ceased to exist as viable nations—Rwanda, Somalia, Liberia, the former Ivory Coast—and their populations face mass starvation. The UNHCR and multiple nongovernmental organization relief agencies have been relatively ineffective dealing with this problem.

(U) Major offshore oil fields off of West Africa have been threatened, alternately, by competing revolutionary groups or the military. Several acts of sabotage or terrorism have resulted in damage to a major offshore tanker loading port and have driven up the price of African crude oil.

(U) A vacuum exists in Africa due to the centuries-long deadly effects of the AIDS virus and other diseases, further complicated by lack of medical support and education in this region. Some nations have taken advantage of this situation to expand their presence in Africa in order to acquire and control natural resources. As a result, Africa has become a major recruiting base for terrorist and criminal organizations.

(U) Americas. The majority of the population remains in the barrios, getting poorer and more distant from the opportunities of the early 21st century. Additionally, many countries in the region still lack the resources necessary to move beyond a commodity-based economy. The major security threats to the regional states have generally not been from their neighbors, but rather from domestic insurgencies, drug trafficking, organized crime, and natural environmental disasters, such as hurricanes and earthquakes.

(U) Asia

(U) North and South Korea united in a single peninsular state in 2006 after North Korea imploded, largely as a result of ongoing famines and economic chaos. The new nation adopted the South Korean form of government and economic system. Concern of a negative impact on the economy of the south, as they combined with the north, was well founded. Without a Korean "Marshall Plan" instituted by the U.S., recovery would have taken much longer. Korea retains close security ties to the U.S. to ensure its national security, and a greatly reduced U.S. military presence remains in country. Korea strengthened its political and economic ties with Japan and Taiwan.

(U) China. In recent years, the government of China has experienced challenges and disruptions to its plan of continued growth and has widened its sphere of influence. The transition to capitalism has created huge stresses within the economy and society and has threatened the political order. An internal conflict exists between the disenfranchised

interior sections and the more industrial coastal regions, causing China to become much more internally focused.

(U) Despite this, China possesses the strongest and largest economy and military in Asia. China maintains strong commercial ties with much of the world, especially with the Pacific Rim. Though lacking the sophistication of U.S. technology, China has become a major exporter of military arms worldwide.

(U) China's size, its nuclear capability, its potential to develop large military forces, its uncompromising stance on defending its ocean frontiers, its domestic political uncertainties, combined with its potential for internal chaos, make it a factor in any Asian engagement.

(U) Subnational Entities: Terrorism, Organized Crime, Pirates, Black Markets, and Multinational Corporations

(U) Terrorism continues to be a major destabilizing factor in world events. Middle Eastern terrorists continue to lash out against non-Islamic influences in the Middle East. Saudi Arabia, Qatar, and Kuwait have become less stable in the face of rising "anti-infidel" sentiment, and an overthrow of any of these governments could result in renewed large-scale conflict in the region.

(U) The U.S.-led war on terrorism continues across much of the world, with significant activity in the recognized hotspots. Due to their high standard of living and open societies, the U.S., the European Union, and Japan are the principal targets for terrorist attacks.

(U) Organized crime is prospering. The continuing demand for narcotics maintains a booming market for the drug cartels. Opiates and narcotics are sold by criminal organizations that emanate from South America and Southern Asia. Drug cartels have successfully established processing and distribution infrastructures in most nations, including the U.S.

(U) Both terrorists and organized crime are adept at exploiting high technology in their operations and possess adroit business acumen in the management of their operations. Both employ advanced and sophisticated weapons and have become formidable foes.

(U) Piracy has been increasing worldwide, reaching new levels of sophistication, brazenness, and brutality. The pirates are better equipped with modern weaponry and communications and know of shipping and law enforcement activities. Unsupported suspicions exist of collusion among pirates, governments, and law enforcement agencies of several nations that border strategic sea lines of communication. As an adjunct to piracy, human trafficking has grown, both as a source of virtually free labor and as a solution to ethnic disagreements.

(U) Discovered Oil

(U) Multinational corporations enabled rapid economic growth with their quick development of the newly discovered oil and gas fields. In fact, intense competition

existed among corporations to secure development rights. As the situation evolved, both nations of interest saw that it was to their own advantage to cooperate to gain the greatest possible advantage from the oil corporations. In return, the corporations agreed to large prepayments and huge infrastructure development programs. The governments of both nations of interest saw basic national improvements as essential first steps, and concurrently began planning for improvements in their defense.

(U) Nationalist economic policies continued to be promoted. In addition to the existing banking and financial structure run by a small Chinese middle class, the government promoted indigenous small and medium businesses, and encouraged the establishment of Islamic Banks and the continued faith in an antiquated network of cooperatives.

(U) Political Change

(U) The military remains an essential factor to gain and maintain political power in both nations of interest. They implemented reforms to become more professional and less political. As a result of the overall increases in prosperity and budgets, as well as competition from foreign and domestic corporations, the military reduced their commercial operations.

(U) Military Changes

(U) Early in 2003, the national leaderships of both countries of interest convinced their respective militaries that it was in their own and the national best interests to transition from a public security police-like force to a true national defense force. This was due to the increased need to protect the offshore resources from foreign encroachment. To that end, the military had to project a more professional image. In concert with this, and as incentive to the military, the government agreed to acquire force structure and equipment to match the new security role, including to high-performance coastal defense cruise missiles, patrol boats, and diesel submarines. In exchange for this, the military agreed to begin divesting themselves of commercial interests.

APPENDIX C. EXPERIMENT CONTROL DESCRIPTION

A. PERSONNEL

MN LOE II control personnel consisted of a core cadre, backed by trusted agents in each of the participating nations. This core group included:

- U.S. experiment director
- U.S. chief controller
- National controllers in each country/NATO SACLANT (a total of five)
- U.S. planner lead
- U.S. SoSA lead
- Functional leads.

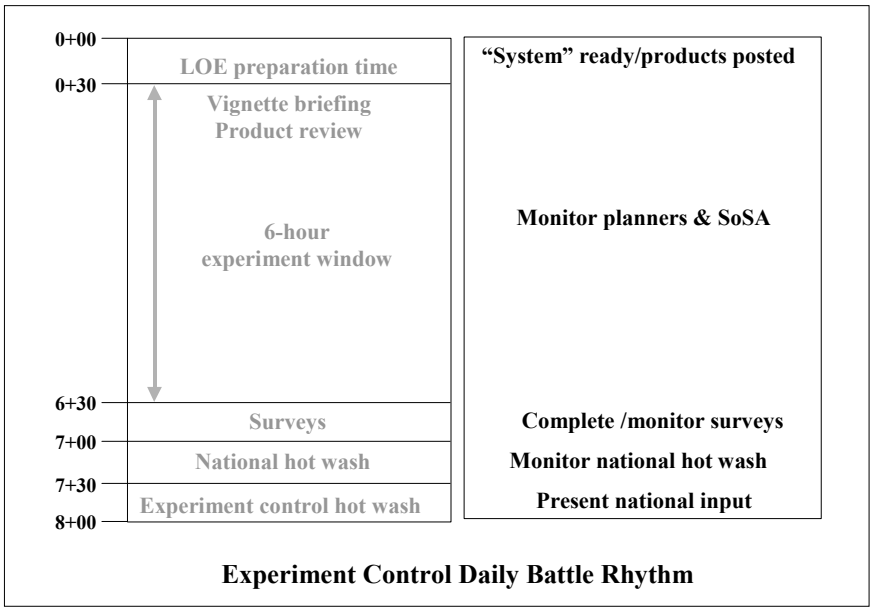
Additional personnel provided "white cell" support in monitoring the different collaborative shared spaces, along with backing up primary control personnel. Each control position was identified in Groove with a "CC" prefix prior to the station number.

B. EXECUTION CONTROL VIRTUAL HEADQUARTERS

A separate space was set up within the Groove collaborative architecture to provide the control cell with a private location for discussions and direction. This "CC" space was accessible only to the core cadre.

C. EXPERIMENT CONTROL DAILY BATTLE RHYTHM

The four experiment days per week were eight hours in length; six hours were dedicated to actual experiment play, and the remaining time to LOE preparation, surveys, national hot washes, and experiment control hot washes. During Week 1 on Thursday, and during Week 2 on Friday, an after-action review focused on the senior concept developers. On the Fridays of Week 1 and Week 2, national hot washes focused on the experiment audience.



Experiment Control Daily Battle Rhythm

D. U.S. LNO RESPONSIBILITIES

A representative from USJFCOM J9 was deployed to each of the four participating countries to help facilitate the experiment. In addition to their understanding of the experiment's mechanics, these personnel received extra training and in-depth briefings on the various concepts being explored. Representing U.S. interests, and not part of the "formal" host nation experiment control cadre, the LNOs:

- Worked LNO-to-LNO back-channel communications to ensure success of national lead controller success
- Provided on-the-spot U.S. technical assistance to their national team
- Provided U.S. assistance to the national lead controller
- Provided the national lead controller with vignette products from the MN LOE II CD for action
- Acted as a cultural bridge.

E. NATIONAL LEAD CONTROLLER DUTIES

Each country's national lead controller:

- Posted national "white cell" vignette products prior to the start of the vignette (All vignette products were posted by the national "white cell" LNO at the end of the previous experiment day, due to Groove/CFBL net bandwidth limitations.)
- Determined national tool and concept training requirements
- Monitored national tool and concept training for their national experiment audience and national experiment control team

- Monitored daily national hot wash
- Presented results of daily national hot wash at the daily experiment control hot wash
- Facilitated the national portion of the after-action review during Week 1 and Week 2
- Supported multinational information-sharing, concept-of-operations play
- Ensured that national systems, spaces, and teams were ready to support daily experiment play
- Ensured experiment execution in accordance with the experiment control plan
- Coordinated the national part of in-focus/azimuth-check sessions
- Advocated survey/human factors participation.

F. MULTINATIONAL LNO/NATO SACLANT RESPONSIBILITIES

Each participating nation and NATO SACLANT sent a representative to the USJFCOM J9 facility in Suffolk, Va., who:

- Represented national/NATO SACLANT interests
- Was not a formal part of experiment control
- Provided remote/local assistance to the national teams
- Provided assistance to the U.S. chief controller
- Acted as a cultural bridge.

G. ROLE PLAYING AND REQUESTS FOR INFORMATION

National white cell personnel in each country represented national entities. For the U.S., State Department and the Defense Intelligence Agency were represented. Additionally, the formal request-for-information process was not used because of MN LOE II manpower limitations. White cell SoSAs or scenario writers answered information queries.

H. VIGNETTE EXECUTION

The process undertaken during the first few hours of each vignette included these steps:

i. Vignette scenario brief was given by the U.S. chief controller on Groove and posted in the coalition shared space.

ii. Vignette scenario Word document was posted on Groove in the coalition shared space.

iii. Supporting products were extracted by the J9 LNO from MN LOE II CD and were provided to the national lead controllers.

iv. The national lead controller notified his national plans lead and SoSA lead that new products have been posted in his national private shared space.

Week 1 "as is" MNIS:

i. The products were posted to proper MNIS domain spaces as identified by the security classification caveat, i.e., ML, TL, BL1, BL2, coalition, or private.

ii. Further product distribution required national disclosure process approval.

iii. If approved for further dissemination, the product was remarked/sanitized and reposted to the appropriate MNIS domain space.

Week 2 "future" MNIS:

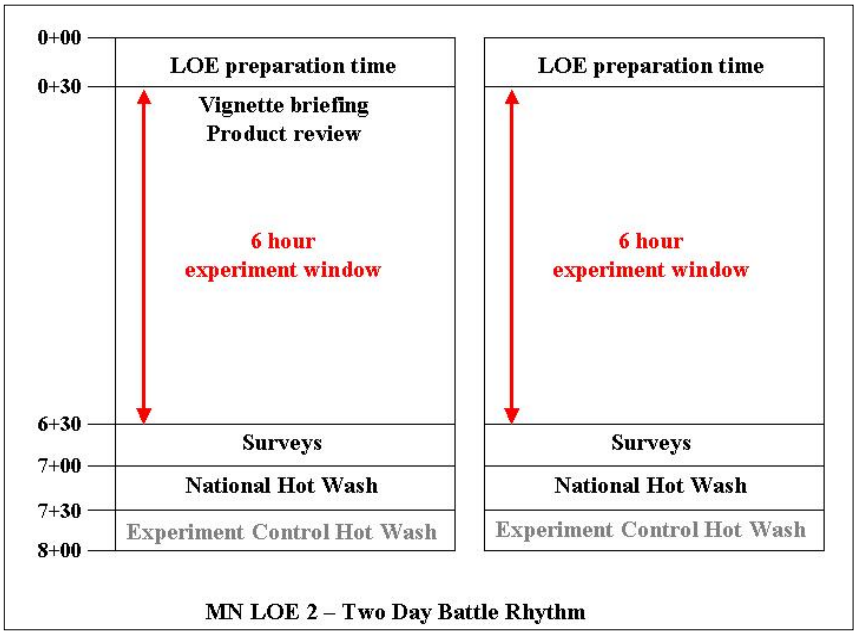
i. The product was placed in the proper MNIS domain space (coalition or private).

ii. Further product distribution required Coalition Information-Sharing Policy and Procedures Panel disclosure process approval.

iii. The national plans lead and/or SoSA lead determined how to notify their counterparts in the various MNIS domains of the new national information that is being put into play by their nation ("as is" and "future" MNIS).

I. VIGNETTE BATTLE RHYTHM

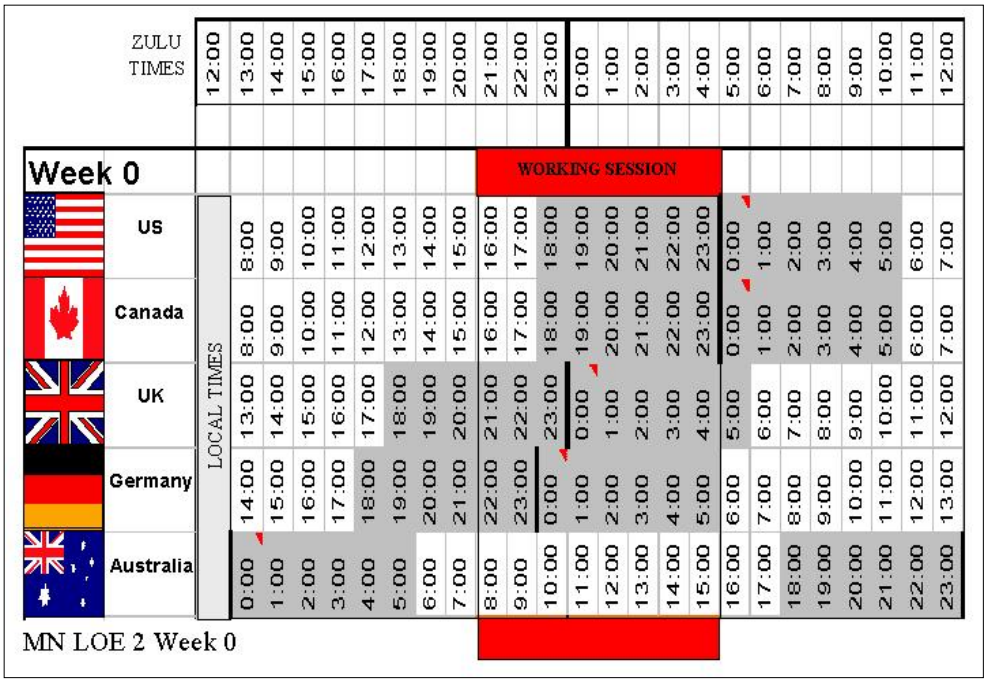
Four vignettes were presented to the experiment audience during the two-week experiment execution period. Each vignette was allocated two days for the plans and SoSA personnel to review and act on the injects/products available through the MNIS collaborative process. During those two eight-hour workdays, six hours per day were spent on actual product review and ENAR development.

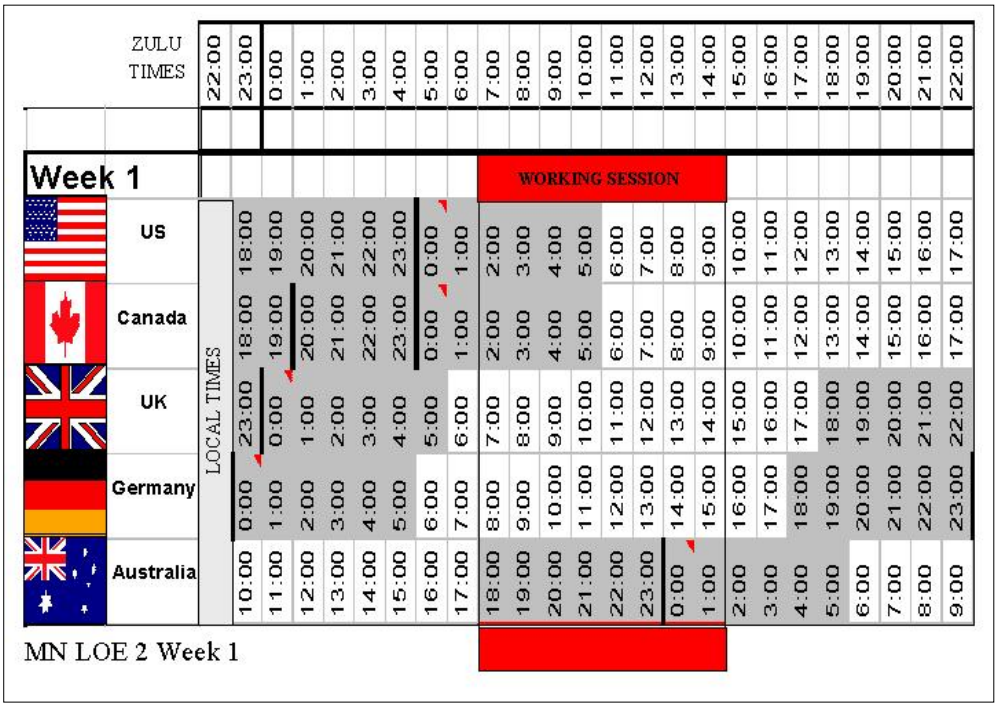


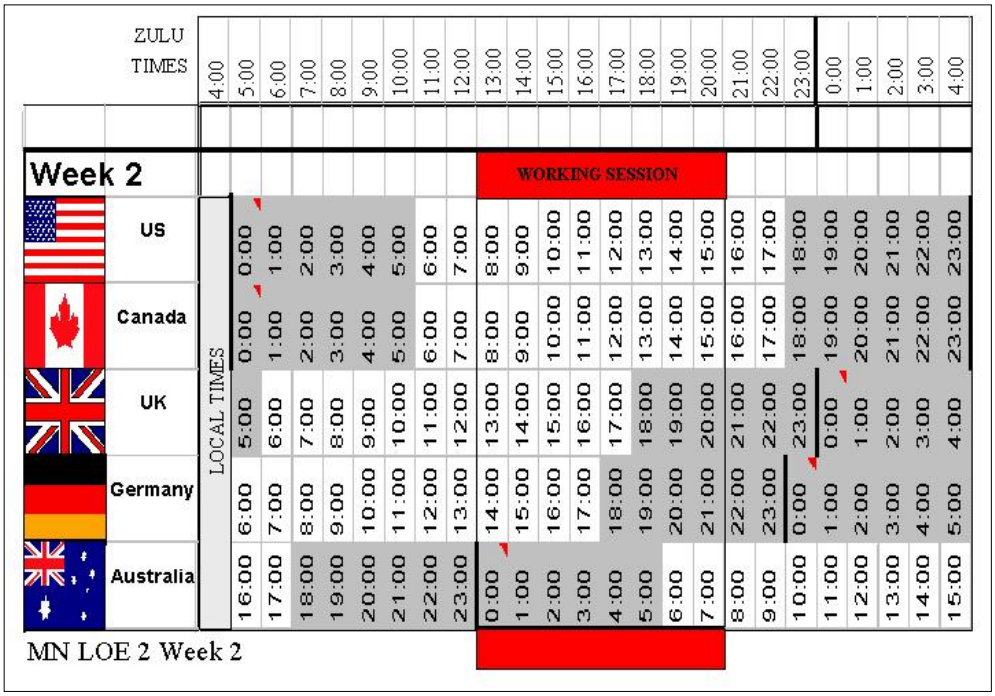
MN LOE 2 – Two Day Battle Rhythm

J. DAILY EXPERIMENT TIMES

Because of the distributed location of the participants, the eight-hour experiment window was at different local times in each country for each week. This allowed all participants to experience at least one "normal" duty period during the three-week experiment. ZULU times were used during the event for all control and scheduling functions. These charts depict how the eight-hour window cycled through the different countries local times:







K. CLASSIFICATION OF EXPERIMENT PARTICIPANTS AND OBSERVERS

1. Participant

Participant is a generic term for LOE member nations and representatives who collaborated and who were directly involved in the development of a concept. Specifically, participants:

- Are represented by a voting member within the LOE. LOE representation is defined as "a dictate and/or statement within a formal memorandum of agreement, memorandum of understanding, or official assignment to USJFCOM, which authorizes participation in the U.S.-sponsored LOE event."
- Are responsible for appropriate LOE national planning, programming, budgeting, personnel assignment, operations, administration, analysis and assessment, or any combination thereof
- Are authorized users and/or administrators of the hardware, software, and networks associated with the LOE
- Have full access to classified information, based on right and need to know.

2. Observer

Observer is a generic term for member nations, nonmember nations, or alliances and representatives who are non-collaborators in the development of a concept. Observers are allowed access to information and are allowed to watch the execution of preapproved portions of the LOE process. Specifically, observers:

- Are member nations, nonmember nations, or alliances and representatives who have been preauthorized to possess observer status by all voting members of the LOE
- Watch from a geographic location that is preapproved by all voting members of the LOE
- Participate in the LOE execution phase without interfering. For example, an observer is not authorized to use LOE hardware, software, or network, and is not authorized to engage in formal discourse with the LOE participants during the LOE process.
- Are not authorized to use radio frequency equipment, such as cell phone; magnetic media, such as recording devices and computers; electronic devices, such as PDAs, pens, pencils, and paper; or any other item not preapproved by all voting members of the LOE
- Must be approved by all voting members of the LOE for formal receipt of any LOE documentation and electronic media
- Are restricted to unclassified information access only.

3. Visitor

Visitor is a generic term for LOE members, non-member nations, or alliances and representatives who are non-collaborators in the development of a concept. Visitors are allowed limited and controlled access to information or events related to a concept or LOE process. Visit requests require pre-approval by all voting members of the LOE. Visitors from LOE voting and nonvoting member nations are very important persons, high-ranking officials, and/or other personnel who temporarily visit a portion of the LOE process. Those from member nations are accorded all the applicable privileges of an LOE participant during the visit; those from nonvoting member nations must comply with observer rules and restrictions during the visit.

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APPENDIX D. SENIOR CONCEPT DEVELOPER PARTICIPATION

A. PURPOSE OF SCD PROGRAM

A significant element of warfighting experimentation is the participation of a select group of former general and flag officers. These individuals participate in a variety of activities as a source of experience and knowledge that contributes to the growing understanding of the concepts being examined during the experiment. In all cases, the intent is to use their knowledge, experience, expertise, and high-level influence to refine concepts used to transform the military forces for the future.

B. SUMMARY OF SCD PARTICIPATION

Given the multinational context of MN LOE II, the seven senior concept developers who participated in this experiment appropriately were from each of the participating nations—two from the United States, two from Germany, and one each from Australia, Canada, and the United Kingdom. To use the richness of their individual and collective experiences and intellects to the fullest, they served as:

- Senior advisors to the experiment director during Weeks 1 and 2
- Senior observers and assessors during Weeks 1 and 2
- Participants in four in-focus sessions
- Participants in four azimuth-check sessions
- Participants in two after-action reviews
- Authors of detailed written assignments.

C. KEY EVENTS

The SCDs initially participated in two days of training, January 15-16, including briefings on the ONA and MNIS concepts, SCD responsibilities, experiment objectives and construct, and the use of Groove as the collaborative tool to support experiment play. This short period of time also allowed the SCDs to greet each other personally—perhaps the only time they would meet face-to-face during the globally distributed experiment. Even with no prior working relationships, they quickly engaged in several high-level discussions and made some major observations.

Besides observing the collaborative activity of the experiment players within the various Groove spaces, the SCDs spent a significant portion of the first two weeks in collaboration among themselves. This generated a large volume of written material that has led to a clearer understanding of many multinational concept issues. These exchanges not only prepared the SCDs for—and consequently enriched—the in-focus and azimuth sessions, but they also laid some of the groundwork for the two-day, post-experiment seminar conducted on March 17-18.

Two teleconference in-focus sessions occurred each week to generate discussion about the two concepts that were examined: multinational information sharing and operational net assessment. The topic and timing of each question were carefully coordinated with the critical operational issues of the experiment activity at that time. These facilitated sessions encouraged "out-of-the-box" discussion that extended concept exploration beyond the scope of the experiment objectives.

The SCDs also participated in azimuth-check sessions. Like the in-focus sessions, these twice-weekly teleconferences offered facilitated discussion. These forums allowed the analysts to share their views of the effectiveness of the experiment to support the objectives. The sessions also allowed senior concept developers to share their insights regarding the critical operational issues.

Two formally facilitated and teleconferenced After Action Reviews were conducted during the experiment, one near the end of Week 1 and a Final AAR on the last day of Week 2. While the primary participants in the AARs included the National Planners and SoSA Analysts, the SCDs again were queried for their thoughts regarding their observed strengths and weaknesses of the concepts as they were applied in the experiment and also their perceptions of the attributes of the experiment's design and control apparatus. Additionally, all participants were challenged to provide comments on concept-related questions that focused on the week's experiment activity. It was in this instance again that the SCDs contributed valuable insights, valuable in the sense that their assessments were created through the lens of their unique, collective experience and understanding.

During the March 17–18 meetings of the senior concept developers, they reviewed the analysts' preliminary assessments and provided qualitative input based on their collective participation. Admiral E.P. Giambastiani, Commander, U.S. Joint Forces Command, enjoined them to identify specific, high-level recommendations for his immediate action.

D. HIGH-LEVEL SCD RECOMMENDATIONS

Senior concept developers identified two levels of recommendations for action by high-level military and government officials. Level 1 recommendations were deemed essential to the development of the concepts; they require the personal attention and support of commander of USJFCOM. Level 2 recommendations should be brought to the commander's attention, but should be implemented at a subordinate level.

Level 1 Recommendations

1. A real-world scenario should be used for the next multinational experiment, scheduled for February 2004. All nations involved in the experiment could provide a working database to address the associated elements of DIME and PMESII. Additionally, this dynamic scenario would be beneficial to each nation's knowledge base and national activity in the area. The senior concept developers unanimously and emphatically endorsed the importance and value of this recommendation. Other advantages include:

- Greater detail in the ONA database
- Greater stress placed on the ONA process and on the MNIS hypothesis
- Increased political support and multinational interagency participation
- Development of real-world nodes, links, actions, and resources
- Generation of an effects plan that's useful to experimentation and ongoing stability operations.

2. The commander, USJFCOM, should advise the Department of Defense to review Directive 5230.11, an information-sharing policy, to reflect the demanding requirements of the information age. While every nation would have a foreign disclosure policy regarding highly classified information, the philosophy behind this directive should emphasize "withholding information by exception" in a coalition environment for joint doctrine development.

3. A knowledge white paper should be developed to generate further study, debate, and exploration of this critical aspect of future joint and combined operations. The paper should define knowledge and should address the supporting elements of knowledge superiority, management, readiness, and warfare. Although current joint force concepts emphasize the value of and necessity for knowledge, a distinct "knowledge concept" does not exist that explores knowledge-related issues.

Level 2 Recommendations

1. The concept of national knowledge advantage centers should be expanded. The ONA process requirements of the standing joint force headquarters should be used as a forcing function for this purpose.

2. The multinational collaborative information environment should begin 120 days prior to the start of the next multinational experiment, allowing a realistic development of the ONA database. In addition, it would facilitate simultaneously an in-depth exploration of the strengths and weaknesses of persistent collaboration over time and space.

3. The ONA naming convention should be reexamined. Although the ONA concept was considered to be a necessity, its nomenclature is confusing to our multinational partners, as well as to some of our own military and government personnel. The concept development pathway should embrace both the principles and processes of ONA; however, the ONA name should be changed to "effects analysis" or some other commonly understood and agreed-upon term.

4. The lessons learned from this experiment on multinational information sharing should be added to the Pinnacle Impact 03 experiment.

5. Efforts should continue to embed a simpler and more effective MNIS concept into joint doctrine development. The current Draft JP2-02 is on the right track.

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APPENDIX E. SoSA ACTIVITIES LEADING TO MN LOE II

- **Mid-August 2002 until Workshop I**
  - Conducted background research on and system-of-systems analysis of the countries of interest
  - Developed 2002 PMESII summaries of countries of interest
  - Prepared briefings on the PMESII summaries
  - Participated in the technical development of the new database for MN LOE II; provided thoughts and requirements for the new database
  - Conducted exploratory meetings for ClearForest use
  - Participated in MN LOE2 initial planning conference
  - Developed workshop plan

- **Workshop I, Sept. 30–Oct. 2, 2002**
  - Executed Workshop I plan
  - Developed and presented ONA system-of-systems analysis briefing
  - Presented PMESII summary briefs for both countries of interest
- **Oct. 3, 2002, to Workshop II**
  - Continued research on and system-of-systems analysis of countries of interest
  - Supported white cell scenario and LOE construct development
    - Provided background material for scenario refinement
    - Supported vignette development; reviewed/critiqued drafts, provided background material
    - Attended weekly white cell development meetings
    - Reviewed proposed LOE construct
  - Researched and wrote 2010 PMESII summary updates
  - Initiated node selection for the ONA database
  - Continued to support technical development of the database
  - Developed Workshop II plan
  - Developed Workshop II ONA training briefing
  - Prepared PMESII example training briefing for Workshop II
  - Prepared 2010 PMESII update briefings for Workshop II
  - Participated in MN LOE II final planning conference

- **Workshop II, Nov. 5–7, 2002**
  - Executed Workshop II plan
  - Presented ONA training briefing
  - Presented PMESII example training briefing
  - Presented PMESII update briefings for both COI
  - Participated in development of red-blue, blue-red, red-red, and blue-blue views
  - Participated in ClearForest familiarization session

- **Nov. 8 to Workshop III**
  - Continued node selection for the ONA database
  - Provided final inputs to the technical development of the database
  - Researched and prepared node related resources for the database
  - Began entering nodes and resources into the database (Dec. 2, 2002)
    - Created node and resource identification numbering schemes
    - Created resource documents from sources (books, articles, Web pages)
  - Prepared and presented briefings on ONA process, system-of-systems analysis, database entry, PMESII 2002 summaries, and PMESII 2010 updates for NATO /SACLANT participants
  - Prepared and presented briefings on ONA process, system-of-systems analysis, database entry, PMESII 2002 summaries, and PMESII 2010 updates for UK participants
  - Provided database user expertise to support multiple ONA database training sessions
  - Reviewed white cell MSEL injects for the LOE
  - Reviewed final white cell vignette drafts
  - Modified and entered all Australian, Canadian, and German products into the ONA database
    - Modified the nodes to match U.S. node format already in the database
    - Eliminated redundancies among national inputs
    - Modified Australian, Canadian, and German resource inputs so database would accept the resource data
    - Created additional resources to better justify Australian, Canadian, and German nodes
  - Commenced node-to-node linking process
  - Created ONA database business rules

- Prepared briefing on the rules

- **Workshop III, Jan. 13–17, 2003**

  - Executed Workshop III plan
  - Presented briefings on SoSA use of the database and database business rules
  - Participated in Groove training
  - Participated in wargaming phase of the baseline ONA development
  - Participated in effects development

- **Workshop III to MN LOE II**

  - Standardized database node and resource identification nomenclature
    - Made changes to Australian, Canadian, German, and UK nodes/resources for standardization to ease database search
  - Continued to make node-to-node links
  - Participated in ClearForest training
  - Corrected German nodes as per their request
  - Added NATO node/resource data into database
    - Resolved conflicts among NATO nodes
    - Standardized their input with rest of the database
    - Created resources to support NATO nodes
  - Modified ONA SoSA business rules as per Workshop III suggestions
  - Prepared ONA database SoSA training materials

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APPENDIX F. DATA COLLECTION MATRIX

The data collection matrix was a planning tool that the experiment analysts used to organize all sources of data in one location. After all data sources were listed, analysts could see clearly whether each experiment objective and countries-of-interest area had been addressed. It was also used as a bookkeeping tool for analysis. The matrix contains measures for each objective and COI, as well as respective survey questions. It also categorized the data source and collection frequencies. Additional indices used for bookkeeping only are not shown in this appendix. The finalized data collection matrix used for MN LOE II is listed in the subsequent pages.

Sequence No.			OBS	SVY	C4I	SCD	Freq.
1	1	**Objective: Identify and assess issues associated with the ability of national headquarters staffs to conduct a distributed ONA**					
2	1.1	**COI: Is the US ONA process viable in a coalition environment?**					
3	1.1.1	Measure: Rating of viability of US ONA process in a coalition environment					
4		Hypothesized response: The US ONA process is viable in a coalition environment despite differences in partner organizations and command relationships					
5	1.1.1.1	Data requirement: Viability of US ONA process in a coalition environment					
6	1.1.1.1.1	Data element: Survey questions					
7		1. The US ONA process is viable in a coalition environment (agree scale)		POC			W1 W2
8		2. The ONA process improved the operational planning process with coalition partners. (Improve Scale)		POC			W2
9		3. What kinds of problems did players spend a lot of time trying to solve? (Narrative)	X	PC			W1 W2
10	1.1.2	Measure: Rating of impact of unequal access to data on the ONA process					
11		Hypothesized response: Unequal access had an impact on the ONA process but all participants were able to contribute to the process.					
12	1.1.2.1	Data requirement: ONA users perception of impact of unequal access to ONA data					
13	1.1.2.1.1	Data element: Survey questions					
14		1. I was able to perceive instances where it was apparent that participants had unequal access to data. (true/false) If so describe.	X	P			W1 W2
15		2. Unequal access to ONA data had a significant impact on the ONA process. (agree scale)		POC			W1 W2
16		3. To what degree do you feel participants could provide needed information to other members during the ONA development process? (degree scale)	X				W1 W2
17	1.1.3	Measure: Frequency of ONA knowledge base access					
18		Hypothesized response: Knowledge base access may change as participant's understanding of the ONA process improves.					
19	1.1.3.1	Data requirement: Number of knowledge base accesses by each participant in the coalition network over time					
20	1.1.3.1.1	Data element: Number of knowledge base accesses by each participant in the coalition					
21		1. Number of knowledge base accesses by each participant in the coalition network			X		Hourly
22	1.1.4	Measure: Frequency of ONA knowledge base update					
23		Hypothesized response: Knowledge base updates may change as participant's understanding of the ONA process improves.					
24	1.1.4.1	Data requirement: Number of knowledge base updates made by each participant in the coalition network over time					
25	1.1.4.1.1	Data element: Number of knowledge base updates made by each participant in the coalition network					
26		1. Number of knowledge base updates made by each participant in the coalition network			X		Hourly
27	1.1.5	Measure: Frequency of collaborative document access					
28		Hypothesized response: Collaborative document access may change as participant's understanding of the ONA process improves.					
29	1.1.5.1	Data requirement: Number of collaborative document accesses by each participant in the coalition network over time					

Sequence No.			OBS	SVY	C4I	SCD	Freq.
30	1.1.5.1.1	Data element: Number of collaborative document accesses by each participant in the coalition network					
31		1. Number of collaborative document accesses by each participant in the coalition network			X		Hourly
32	1.1.6	Measure: Frequency of collaborative document update					
33		Hypothesized response: Collaborative document update may change as participant's understanding of the ONA process improves.					
34	1.1.6.1	Data requirement: Number of collaborative document updates made by each participant in the coalition network over time					
35	1.1.6.1.1	Data element: Number of collaborative document updates made by each participant in the coalition network					
36		1. Number of collaborative document updates made by each participant in the coalition			X		Hourly
37	1.1.7	Deleted					
38	1.1.8	Measure: Rating of the perceived usefulness of ONA process					
39	1.1.8.1	Data Requirement: ONA user's perceptions of the usefulness of ONA					
40	1.1.8.1.1	Data Element: Survey Questions (all 7-point Likert Agree Scale)					
41		1. The ONA process allows me to accomplish tasks more quickly.		P			Wed Weekly
42		2. Using the ONA process increases my productivity.		P			Wed Weekly
43		3. Using the ONA process improves my job performance.		P			Wed Weekly
44		4. Using the ONA process enhances my effectiveness on the job.		P			Wed Weekly
45		5. Using the ONA process makes it easier to do my job.		P			Wed Weekly
46		6. Overall, I find the ONA process useful in my job.		P			Wed Weekly
47	1.1.9	Measure: Rating of the perceived ease of use of ONA					
48	1.1.9.1	Data Requirement: ONA user's perceptions of the ease of use of ONA					
49	1.1.9.1.1	Data Element: Survey Questions (all 7-point Likert Agree Scale)					
50		1. Learning to use the ONA process was easy for me.		P			Wed Weekly
51		2. During MNLOE I found it easy to get the ONA process to do what I wanted it to.		P			Wed Weekly
52		3. During MNLOE I found the ONA process flexible to interact with.		P			Wed Weekly
53		4. During MNLOE the ONA process was clear and understandable.		P			Wed Weekly
54		5. I found it easy to become skillful at using the ONA process.		P			Wed Weekly
55		6. Overall, I find the ONA process easy to use.		P			Wed Weekly
56	1.1.10	Measure: Rating of perceived behavioral control of ONA					
57	1.1.10.1	Data Requirement: ONA user's perception of their behavioral control of ONA					
58	1.1.10.1.1	Data Element: Survey Questions (all 7-point Likert Agree Scale)					
59		1. I have the necessary training to use the ONA process.		P			Wed Weekly
60		2. The training provided has better prepared (assists) me to use the ONA process.		P			Wed Weekly
61		3. Help from colleagues assists me to use the ONA process.		P			Wed Weekly
62		4. I feel I have the necessary skills to use the ONA process.		P			Wed Weekly
63		5. I feel I can control the ONA process when I use it.		P			Wed Weekly
64		6. Using the ONA process is easy for me.		P			Wed Weekly
65	1.1.11	Measure: Rating of ONA-related work processes					
66	1.1.11.1	Data Requirement: ONA user's perceptions of the ONA work processes					
67	1.1.11.1.1	Data Element: Survey Questions (all 7-point Likert Agree Scale)					
68		1. I believe that the ONA process is well targeted to the work of my organization as a whole.		P			Wed Weekly

Sequence No.			OBS	SVY	C4I	SCD	Freq.
69		2. I believe that the ONA process is well targeted to the work of my team.		P			Wed Weekly
70		3. I believe that the ONA process is well targeted to the organizational needs of my organization as a whole.		P			Wed Weekly
71		4. I believe that the ONA process is well targeted to the organizational needs of my team in MNLOE2.		P			Wed Weekly
72	1.1.12	Measure: Rating of confidence and familiarity with ONA					
73	1.1.12.1	Data Requirements: ONA user's perceptions of their confidence and familiarity with ONA					
74	1.1.12.1.1	Data Element: Survey Questions (all 7-point Likert Agree Scale)					
75		1. I am familiar with the use of the ONA process.		P			Wed Weekly
76		2. I am confident when using the ONA process.		P			Wed Weekly
77		3. I believe that in the future I will become as familiar with the ONA process as I am with the existing process.		P			Wed Weekly
78		4. I believe that in the future I will develop as much confidence in the ONA process as I have in the existing process.		P			Wed Weekly
79	1.1.13	Measure: Rating of perceived information supply before, during and after the ONA process was introduced					
80	1.1.13.1	Data Requirements: ONA user's perceptions of information supply before ONA was introduced					
81	1.1.13.1.1	Data Element: Survey Questions (all 7-point Likert Agree Scale)					
82		1. The information supplied to me to date about the ONA process kept me fully informed.		P			Wed Weekly
83		2. The information supplied to me to date about the ONA process was suited to members of my team.		P			Wed Weekly
84		3. The information supplied to me to date about the ONA process was suited to my particular role in my organization.		P			Wed Weekly
85		4. Based on this information the ONA process has met my expectations.		P			Wed Weekly
86	1.1.14	Measure: Rating of perceived subjective norms in relation to the use of ONA					
87	1.1.14.1	Data Requirements: ONA user's perceptions of subjective norms in relation to ONA					
88	1.1.14.1.1	Data Element: Survey Questions (all 7-point Likert Agree Scale)					
89		1. Generally, people in my organization think I should use the ONA process.		P			Tue W0 and 2
90		2. Generally, my friends at work think I should use the ONA process.		P			Tue W0 and 2
91		3. Generally, my superiors think I should use the ONA process.		P			Tue W0 and 2
92	1.1.15	Measure: Rating of ONA-related help from colleagues					
93	1.1.15.1	Data Requirements: ONA user's perceptions of ONA-related help from colleagues					
94	1.1.15.1.1	Data Element: Survey Questions (both 7-point Likert Agree Scale)					
95		1. I have found it easy ask my colleagues for help when using the ONA process.		P			Wed Weekly
96		2. My colleagues have been a useful source of information.		P			Wed Weekly
97	1.1.16	deleted					
98	1.1.17	Measure: Rating of the effect of ONA on work practices					
99	1.1.17.1	Data Requirements: ONA user's perceptions of the effect of ONA on work practices					
100	1.1.17.1.1	Data Element: Survey Questions (all 7-point Likert Importance Scale)					
101		1. I consider that the work of my organization has been improved/worsened by the introduction of the ONA process.		P			Wed Weekly
102		2. I consider that the work of my team has been improved/worsened by the introduction of the ONA process.		P			Wed Weekly

Sequence No.			OBS	SVY	C4I	SCD	Freq.
103	1.1.18	Measure: Rating of the organizational behaviors before and after the introduction of the ONA process					
104	1.1.18.1	Data Requirements: ONA user's perceptions organizational behaviors before and after the introduction of ONA					
105	1.1.18.1.1	Data Element: Survey Questions (all 7-point Likert Importance Scale)					
106		Read each statement and select the number (1-7) that best represents your response;					
107		1. Attending to detail.		P			Mon W0, Thu W2
108		2. Relying on others.		P			Mon W0, Thu W2
109		3. Not making work for others.		P			Mon W0, Thu W2
110		4. Being familiar with tasks beyond your own job.		P			Mon W0, Thu W2
111		5. Doing your job well.		P			Mon W0, Thu W2
112		6. Working flexibly.		P			Mon W0, Thu W2
113		7. Understanding your job boundaries.		P			Mon W0, Thu W2
114		8. Understanding the job boundaries of others.		P			Mon W0, Thu W2
115		9. Owning a problem until it is resolved.		P			Mon W0, Thu W2
116	1.1.19	Measure: Senior Concept Developer perspectives on the ONA process					
117	1.1.19.1	Data Requirements: Senior Concept Developer perspectives on the ONA process					
118	1.1.19.1.1	Data Element: Survey Questions (all narrative response)					
119		Collaboration among organizations within your nation should facilitate the collecting of information and data in support of ONA development.				X	17-Feb
120		Your national input to the ONA should include information on adversary elements of power (PMESII) that was obtained from a wide variety of national organizations.				X	17-Feb
121		Through multinational collaboration, the ONA process identified logical, potential effects of friendly actions and the probable adversary responses based on knowledge of ourselves and of the adversary.				X	19-Feb
122		Through multinational collaboration, the ONA process identified specific nodes, actions, and resources to cause desired effects.				X	19-Feb
123		Through multinational collaboration, the ONA process effectively and rapidly aggregated and synthesized data and information into coherent knowledge enabling faster and better				X	19-Feb
124		The ONA process can improve coalition planning as compared to current methods.				X	20-Feb
125		The creation of a coalition ONA is viable assuming there are no impediments to multinational information sharing.				X	20-Feb
126	1.2	**COI: What are the impacts of cultural and/or organizational differences on coalition collaboration?**					
127	1.2.1	Measure: Rating of impact of cultural and/or organizational differences on coalition collaboration.					
128		Hypothesized response: Cultural and organizational differences had perceptible impacts on coalition collaboration.					
129	1.2.1.1	Data requirement: User perception of impact of cultural and/or organizational differences on coalition collaboration					
130	1.2.1.1.1	Data element: Survey questions					
131		1. Cultural differences had an impact on the coalition collaboration process. (Impact scale)	X	PC			W2
132		2. Cultural differences had an impact on the quality of information in the ONA knowledge	X	PC			W2

Sequence No.			OBS	SVY	C4I	SCD	Freq.
133		3. Organizational differences had an impact on the coalition collaboration process. (Impact scale)	X	PC			W2
134		4. Organizational differences had an impact on the quality of information in the ONA knowledge base. (Impact scale)	X	PC			W2
135		5. Key stakeholders were integral part of the planning process.	X				as occurs
136	1.2.2	Measure: Rating of leadership qualities relevant to assessing coalition collaboration in MNLOE2					
137	1.2.2.1	Data Requirements: MNLOE2 participant's perceptions of leadership					
138	1.2.2.1.1	Data Element: Survey Questions (all 7-point Likert Agree Scale)					
139		1. During MNLOE policy and strategy were communicated and implemented.		P			Thu W1 & 2
140	1.2.3	deleted					
141	1.2.4	deleted					
142	1.2.5	Measure: Rating the MNLOE2 management practices relevant to assessing coalition collaboration					
143	1.2.5.1	Data Requirements: MNLOE2 participant's perceptions of MNLOE2 management practices					
144	1.2.5.1.1	Data Element: Survey Questions (all 7-point Likert Agree Scale)					
145		1. During MNLOE the ONA business rules were articulated, understood and consistently		P			Mon W1, Tue W2
146		2. During MNLOE communication channels were open and effective within my organization.		P			Mon W1, Tue W2
147		3. During MNLOE processes for decision-making allowed for informed input and sufficient focus on issues presented.		P			Mon W1, Tue W2
148		4. During MNLOE the tools in support of planning were adopted and used.		P			Mon W1, Tue W2
149		5. During MNLOE a risk management mindset informed decisions about business practice.		P			Mon W1, Tue W2
150		6. During MNLOE key stakeholders were an integral part of planning processes.		P			Mon W1, Tue W2
151		What tool functions got in the way? (Narrative)		POC			W1 W2
152		What additional tool functions would have been helpful? (Narrative)		POC			W1 W2
153		Business rules were sufficiently comprehensive covering all that was needed for conducting the ONA process (agree scale)	X	POC			W1 W2
154		Tools allowed easy search and access of needed information. (agree scale)		P			W1 W2
155		Did you know when the ONA knowledge base had been updated? (Frequency scale)	X	P			W1 W2
156	1.2.6	Measure: Rating MNLOE systems and processes relevant to assessing coalition collaboration					
157	1.2.6.1	Data Requirement: MNLOE participant's perceptions of MNLOE systems and processes					
158	1.2.6.1.1	Data Element: Survey Questions (all 7-point Likert Agree Scale)					
159		1. During MNLOE partnerships across nations were well managed.		P			Mon W1, Tue W2
160		2. Tools in support of MNLOE were well managed.		P			Mon W1, Tue W2
161		3. During MNLOE information and knowledge was well managed.		P			Mon W1, Tue W2
162		4. Electronic communication systems used during MNLOE facilitated information sharing.		P			Mon W1, Tue W2
163		5. During MNLOE quality information was gathered electronically.		P			Mon W1, Tue W2
164		6. During MNLOE quality information was gathered by non-electronic means.		P			Mon W1, Tue W2
165		7. During MNLOE quality information was disseminated electronically throughout the organization.		P			Mon W1, Tue W2
166	1.2.7	Measure: Rating the MNLOE work systems relevant to assessing coalition collaboration					
167	1.2.7.1	Data Requirements: MNLOE participant's perceptions of MNLOE2 work systems					

Sequence No.			OBS	SVY	C4I	SCD	Freq.
168	1.2.7.1.1	Data Element: Survey Questions (all 7-point Likert Agree Scale)					
169		1. During MNLOE members of my team were encouraged to collaborate rather than compete with one another.		P			Thu W1 & 2
170		2. During MNLOE I felt free to ask work-related questions of my team members without fear of being judged.		P			Thu W1 & 2
171		3. During MNLOE I trusted decisions made by my leaders.		P			Thu W1 & 2
172		4. During MNLOE conflict in my team was well managed.		P			Thu W1 & 2
173		5. During MNLOE I felt free to discuss my thoughts and opinions on work issues with team members.		P			Thu W1 & 2
174		6. When I was not sure how to do my work during MNLOE I felt comfortable asking others for help.		P			Thu W1 & 2
175		7. During MNLOE I was happy to share my knowledge and expertise with all members of my		P			Thu W1 & 2
176		8. During MNLOE I was happy to share my knowledge and expertise with other personnel in my organization.		P			Thu W1 & 2
177		9. During MNLOE I was happy to share my expertise and knowledge with personnel from other countries.		P			Thu W1 & 2
178		10. During MNLOE when I didn't know how to do a particular aspect of my work I felt I needed to hide my lack of knowledge.		P			Thu W1 & 2
179		11. Please add any comments (Narrative response)		P			Thu W1 & 2
180	1.2.8	Measure: User perception of impact of cultural and/or organizational differences on coalition collaboration					
181	1.2.8.1	Data Requirements: Participants perceived impacts of culture and/or organizational differences on coalition collaboration.					
182	1.2.8.1.1	Data Element: Survey Questions					
183		1. What cultural differences between nations do you think could i) aid and ii) hinder national militaries working together effectively? (Narrative response)		P			Tue wk 0
184		2. List the three most important cultural differences that had an impact on national militaries working together effectively during this week?		P			Thu W0, 1, and 2
185		3. Describe the effects of one of these in detail. (Narrative response)		P			Thu W0, 1, and 2
186		4. List the types of training that you have undertaken in the past two years to understand other cultures and overcome cultural differences? (Narrative response)		P			Wed wk0
187		5. List the (I) formal and (ii) informal processes that are in place in your national military to pass on experiences with other national cultures (for example lessons learned)? (Narrative		P			wed wk0
188		6. The differences between national military cultures are (size scale)		P			Thu W0
189		7. List the three most important organizational differences that had an impact on nations working together effectively?		P			Thu W2
190		8. Describe the effects of one of these in detail. (Narrative response)		P			Thu W2
191	1.2.9	Measure: User perception of impact of the levels of trust between national militaries.					
192	1.2.9.1	Data Requirements: Participants perceived impacts of the levels of trust between national militaries.					
193	1.2.9.1.1	Data Element: Survey Questions					
194		1. The level of trust between participants from my nation had a significant impact on the coalition collaboration process. (agree scale)		P			Thu W0, 1, and 2

Sequence No.			OBS	SVY	C4I	SCD	Freq.
195		2. The level of trust between participants from different nations had a significant impact on the coalition collaboration process. (agree scale)		P			Thu W0, 1, and 2
196		3.The level of trust required between participants from different nations for an effective coalition collaboration process was (degree scale)		P			Thu W2
197		4. How did the level of trust between participants from different nations (i) aid or (ii) hinder them working together effectively? (Narrative response)		P			Thu W0, 1, and 2
198	1.2.10	Measure User perception of the impact of levels of training and experience on the coalition collaboration process					
199	1.2.10.1	Data Requirement: Player perception of training on collaboration process					
200	1.2.10.1.1	Data Element: Survey questions					
201		1. As of today, how familiar are you with the ONA process? (Familiar scale)		P			Daily
202		2. As of today, how comfortable are you with the tools used during the experiment? (Comfort scale)		P			Daily
203		1. Are there differences in the levels of training (relevant to this exercise) between participating national militaries? (Yes/No)		P			Thu W2
204		2. Differences in levels of training between participating national militaries had a significant impact on the coalition collaboration process. (Agree scale)		P			Thu W2
205		3. Are there differences between participating national militaries in relation to training priorities ? Yes/No		P			Thu W2
206		4. Differences in training priorities between national militaries had a significant impact on the coalition collaboration process. (Agree scale)		P			Thu W2
207		5. Are there differences in the levels of experience (relevant to this exercise) between participating national militaries? Yes/No.		P			Thu W2
208		6. Differences in levels of experience between participating national militaries had a significant impact on the coalition collaboration process. (Agree scale)		P			Thu W2
209		7. How familiar were you with the ONA process before this exercise? (familiar scale)		P			Mon W1
210		8. What additional training and/or experience would have helped you to carry out your tasks during this exercise? (Narrative)		P			Thu W2
211		9. Interactions include combined exercises, exchange visits, social interaction and any other form of interaction (please specify). Which of the these forms of interaction had the greatest impact on your ability to work effectively with other national militaries? (Narrative response)		P			Thu W2
212		10. Briefly describe how. (Narrative response)		P			Thu W2
213	1.2.11	Measure: User perception of degree of difficulty of fitting into the command structure.					
214	1.2.11.1	Data Requirement: Player perception of degree of difficulty of fitting into the command					
215	1.2.11.1.1	Data Element: Survey questions					
216		1. Compared to what I am used to, the expectations of superiors of other nationalities were (same scale)		P			Thu W2
217		2. Compared to what I am used to, the command style of superiors of other nationalities was (same scale)		P			Thu W2
218		3. Superiors of other nationalities had a clear understanding of my capabilities (agree scale)		P			Thu W0, 1 and 2
219		4. Superiors of other nationalities were responsive to my needs (agree scale).		P			Thu W0, 1 and 2
220		5. My responsibilities during this exercise were (clear scale)		P			Thu W0, 1 and 2

Sequence No.			OBS	SVY	C4I	SCD	Freq.
221		6. Superiors of other nationalities anticipated my needs. (agree scale)		P			Thu W0, 1 and 2
222		7. I had sufficient authority to carry out my task. (agree scale)		P			Thu W0, 1 and 2
223		8. What problems did you experience with the command and control structure within which you were working during this week? (Narrative response)		P			Thu W0, 1 and 2
224	1.2.12	Measure: User perception of sharing of information and differences in participants understanding.					
225	1.2.12.1	Data Requirement: Player perception of sharing of information and differences in participants understanding.					
226	1.2.12.1.1	Data Element: Survey questions					
227		1. I understood the instructions given (agree scale)		P			Thu W0, 1 and 2
228		2. I understood the terms used (agree scale)		P			Thu W0, 1 and 2
229		3. I understood the communications received (agree scale)		P			Thu W0, 1 and 2
230		4. Participants from other nations understood the instructions given (agree scale)		P			Thu W0, 1 and 2
231		5. Participants from other nations understood the terms used (agree scale)		P			Thu W0, 1 and 2
232		6. Participants from other nations understood the communications received (agree scale)		P			Thu W0, 1 and 2
233		7. Participants from other nations understood my point of view (agree scale)		P			Thu W0, 1 and 2
234		8. The information provided via the shared tools was reliable. (agree scale)		P			Thu W0, 1 and 2
235		9. The information provided via the shared tools was relevant. (agree scale)		P			Thu W0, 1 and 2
236		10. The information provided via the shared tools was easy to understand (agree scale)		P			Thu W0, 1 and 2
237		11. I had access to all of the information required to carry out my task (agree scale)		P			Thu W0, 1 and 2
238		12. What could be done to increase the understanding of information, instructions and/or communications between participating national militaries? (Narrative response)		P			Thu W0, 1 and 2
239	1.2.13	Measure: Senior Concept Developer perspectives on the impact of cultural and/or organizational differences					
240	1.2.13.1	Data Requirements: Senior Concept Developer perspectives on the impact of cultural and/or organizational differences					
241	1.21.13.1.1	Data Element: Survey Questions (all narrative response)					
242		The *political* culture of your nation is compatible with the requirements of the ONA process.				X	18-Feb
243		The *military* culture of your nation is compatible with the requirements of the ONA process.				X	18-Feb
244		The *social customs* of your nation are compatible with the requirements of the ONA process.				X	18-Feb
245		The *political* culture of your nation is compatible with the requirements of sharing information that is required to develop a coalition ONA.				X	24-Feb
246		The *military* culture of your nation is compatible with the requirements of sharing information that is required to develop a coalition ONA.				X	24-Feb
247		The *social customs* of your nation are compatible with the requirements of sharing information that is required to develop a coalition ONA.				X	24-Feb
248	2.0	**Objective: Identify and assess issues associated with collaboration and information sharing across different security domains**					
249	2.1	**COI: Does collaboration with coalition partners across security domains improve the ONA?**					
250	2.1.1	Measure: Percent of data in the ONA knowledge base available to participants					

Sequence No.			OBS	SVY	C4I	SCD	Freq.
251		Hypothesized response: The percent of data in the ONA knowledge base available to participants will increase over time during an individual trial week, and will further increase comparing the future to the current method of information sharing trials.					
252	2.1.1.1	Data requirement: Availability of ONA data to participants at each Coalition network node over time					
253	2.1.1.1.1	Total number of data records available in the ONA knowledge base			X		As Occurring
254	2.1.1.1.2	Number of node data records available in the ONA knowledge base			X		As Occurring
255	2.1.1.1.3	Number of effect data records available in the ONA knowledge base			X		As Occurring
256	2.1.1.1.4	Number of action data records available in the ONA knowledge base			X		As Occurring
257	2.1.1.1.5	Number of resource data records available in the ONA knowledge base			X		As Occurring
258	2.1.1.1.6	Number of data records originator has identified as critical available in the ONA knowledge			X		As Occurring
259	2.1.1.1.7	Total number of data records available to each participant in the Coalition Network			X		As Occurring
260	2.1.1.1.8	Number of node data records available to each participant in the Coalition Network			X		As Occurring
261	2.1.1.1.9	Number of effect data records available to each participant in the Coalition Network			X		As Occurring
262	2.1.1.1.10	Number of action data records available to each participant in the Coalition Network			X		As Occurring
263	2.1.1.1.11	Number of resource data records available to each participant in the Coalition Network			X		As Occurring
264	2.1.1.1.12	Number of data records originator has identified as critical available to each participant in the Coalition Network			X		As Occurring
265	2.1.2	Measure: Rating of situational awareness of each participant in the Coalition Network over					
266		Hypothesized response: Participant situational awareness will increase over time during an individual trial week, and will further increase comparing the future to the current method of information sharing trials.					
267	2.1.2.1	Data requirement: Comparison of user perception with ground truth data.					
268	2.1.2.1.1	Ground truth data for Probe Questions. (Used again on 375)			X		Three Times Daily
269	2.1.2.1.2	Data element: Survey questions					
270		1. How do you rate your overall situational awareness? (quality scale)		P			Daily
271		2. Detailed questions on situations that should be known to the participants at each survey interval. (multiple choice) (Used again on 375)		PC			Three Times Daily
272	2.1.3	Measure: Rating of ONA quality when data is shared across security domains					
273		Hypothesized response: Participants will perceive an improvement in ONA quality when the future information sharing trial is compared to the current method of information sharing trial.					
274	2.1.3.1	Data requirement: ONA users perception of value of collaboration across security domains compared to current methods					
275	2.1.3.1.1	Data element: Survey questions					
276		1. Information sharing across security domains enhanced the quality of information in the ONA knowledge base. (agree scale)		COP			W1 W2
277		2. The ONA knowledge base supported understanding of **Blue's** goals, intentions, strengths and weaknesses. (agree scale)		COP			W2
278		3. The ONA knowledge base supported understanding of **Red's** goals, intentions, strengths and weaknesses. (agree scale)		COP			W2
279		4. Information I needed was in the ONA knowledge base. (Frequency Scale)		P			W1 W2

Sequence No.			OBS	SVY	C4I	SCD	Freq.
280		5. To what degree did Information Sharing Procedures allow you to share information with other members during the ONA development process? (degree scale)		P			W1 W2
281		6. To what degree did Information Sharing Procedures allow other members of the ONA development process to share information with you? (degree scale)		P			W1 W2
282	2.1.4	Measure: Instances of releasability violations.					
283		Hypothesized response: Releasability violations from the ONA knowledge base will decrease as participants become more familiar with disclosure and release policies and procedures.					
284	2.1.4.1	Data requirement: Instances of releasability violations from ONA knowledge base over time					
285	2.1.4.1.1	Data element: Survey questions					
286		Were there any releasability violations today? (Yes/No) If so, describe.	X	P			Daily
287	2.1.5	deleted					
288	2.1.6	deleted					
289	2.1.7	Measure: Rating of Week 1 and 2 differences in collaboration and information sharing					
290		Hypothesized response: Participants will perceive an improvement in collaboration when the future information sharing trial is compared to the current method of information sharing trial.					
291	2.1.7.1	Data Requirement: User perception of differences between Week 1 and Week 2 of collaboration with coalition partners across security domains in the ONA process.					
292	2.1.7.1.1	Data Element: Survey questions					
293		1. What were the top three differences in collaboration between Week 1 and Week 2? (Narrative response)		POC			W2
294		2. What were the top three differences in information sharing between Week 1 and Week 2? (Narrative response)		POC			W2
295	2.1.8	Measure: Rating of satisfaction with the ONA process					
296	2.1.8.1	Data Requirement: ONA user's perception of their satisfaction with the ONA process					
297	2.1.8.1.1	Data Element: Survey Questions (all 7-point Likert Satisfaction Scale)					
298		1. How do you feel about the precision of the information the ONA process provides?		P			Wed Weekly
299		2. How do you feel about the information content provided by the ONA process?		P			Wed Weekly
300		3. How do you feel about how the information provided by the ONA process meets your		P			Wed Weekly
301		4. How do you feel about the sufficiency of the information provided by the ONA process?		P			Wed Weekly
302		5. How do you feel about the accuracy of the information provided by the ONA process?		P			Wed Weekly
303		6. How satisfied are you with the accuracy of the ONA process?		P			Wed Weekly
304		7. How do you feel about the usefulness of the output from the ONA process?		P			Wed Weekly
305		8. How do you feel about the clarity of the information produced by the ONA process?		P			Wed Weekly
306		9. How do you feel about the timeliness of the information provided by the ONA process?		P			Wed Weekly
307		10. How do you feel about the currency of the information provided by the ONA process?		P			Wed Weekly
308	2.1.9	Measure: Senior Concept Developer perspectives on collaboration and information sharing					
309	2.1.9.1	Data Requirements: Senior Concept Developer perspectives on collaboration and information sharing					
310	2.1.9.1.1	Data Element: Survey Questions (all narrative response)					
311		Your nation's diplomatic, information, military and economic (DIME) concerns were satisfactorily addressed through the use of the collaborative process.				X	25-Feb

Sequence No.			OBS	SVY	C4I	SCD	Freq.
312		Information and data that was most critical to the development of the multinational ONA was shared by nations in a satisfactory manner.				X	26-Feb
313		Multinational information sharing effectively supported the ONA process.				X	26-Feb
314		Multinational information sharing was conducted in a timely manner.				X	27-Feb
315		The Future Multinational Information Sharing (MNIS) method improved multinational information sharing as compared to current methods.				X	27-Feb
316	2.2	**COI: What impact does information sharing have on each phase of the ONA process?**					
317	2.2.1	Measure: Rating of impact of information sharing on identification of Potential Effects					
318		Hypothesized response: Participants will perceive that information sharing enhances the quality of potential effects identified.					
319	2.2.1.1	Data requirement: User perception of impact of information sharing on identification of Potential Effects					
320	2.2.1.1.1	Data element: Survey questions					
321		In most cases, the degree to which the coalition conducted Wargaming was sufficient to develop good-quality Effects. (agree scale)	X	PC			W1 W2
322		How often did different national perspectives enhance the development of Effects? (frequency 5 pt)	X	PC			W1 W2
323		Did your nation make compromises about Effects because of opposition by the coalition? If so, what kinds of compromises did your nation make? (narrative)	X	PC			W1 W2
324		What, if any, were the sources of disagreement among nations concerning Effects? (narrative)	X	PC			W1 W2
325		How often could your nation have proposed additional effects to the coalition, but did not in order to protect information? (frequency 5 pt)	X	PC			W1 W2
326		How often did Future information sharing enhance the range of Effects available to the coalition? (frequency 5 pt)	X	PC			W2
327	2.2.2	Measure: Frequency of ONA knowledge base effect record access					
328		Hypothesized response: Effect record access may change as participant's understanding of the ONA process improves.					
329	2.2.2.1	Data requirement: Number of knowledge base effect record accesses by each participant in the coalition network over time					
330	2.2.2.1.1	Number of knowledge base effect record accesses by each participant in the coalition network			X		Hourly
331	2.2.3	Measure: Frequency of ONA knowledge base effect record update					
332		Hypothesized response: Effect record update may change as participant's understanding of the ONA process improves.					
333	2.2.3.1	Data requirement: Number of knowledge base effect record updates by each participant in the coalition network over time					
334	2.2.3.1.1	Number of knowledge base effect record updates by each participant in the coalition network			X		Hourly
335	2.2.4	Measure: Rating of impact of information sharing on identification of Nodes					
336		deleted					
337	2.2.5	Measure: Frequency of ONA knowledge base node record access					
338		Hypothesized response: Node record access may change as participant's understanding of the ONA process improves.					

Sequence No.			OBS	SVY	C4I	SCD	Freq.
339	2.2.5.1	Data requirement: Number of knowledge base node record accesses by each participant in the coalition network over time					
340	2.2.5.1.1	Number of knowledge base node record accesses by each participant in the coalition network			X		Hourly
341	2.2.6	Measure: Frequency of ONA knowledge base node record update					
342		Hypothesized response: Node record update may change as participant's understanding of the ONA process improves.					
343	2.2.6.1	Data requirement: Number of knowledge base node record updates by each participant in the coalition network over time					
344	2.2.6.1.1	Number of knowledge base node record updates by each participant in the coalition network			X		Hourly
345	2.2.7	Measure: Rating of impact of information sharing on Linkage of Effects to Nodes					
346		Hypothesized response: Participants will perceive that information sharing enhances the quality of effect to node linkages identified.					
347	2.2.7.1	Data requirement: User perception of impact of information sharing on Linkage of effects to Nodes					
348	2.2.7.1.1	Data element: Survey questions					
349		How often were Effects sufficiently focused to allow satisfactory Effect-to-Node linkages?	X	PC			W1 W2
350		In most cases, were descriptions of Nodes either too specific or too general to allow satisfactory linkage to Effects? (detail scale)	X	PC			W1 W2
351		How often did different national perspectives enhance Effect-to-Node linkages? (frequency 5	X	PC			W1 W2
352		What, if any, were the differences in how nations approached Effect-to-Node linkages?	X	PC			W1 W2
353		What, if any, were the sources of disagreement among nations concerning Effect-to-Node linkages? (narrative)	X	PC			W1 W2
354		How often did your nation refrain from proposing additional Effect-to-Node linkages to the coalition, in order to protect information? (frequency 5 pt)	X	PC			W1 W2
355		How often did Future information sharing increase the range of Effect-to-Node linkages available to the coalition? (frequency 5 pt)	X	PC			W2
356	2.2.8	Measure: Frequency of ONA knowledge base linkage record access					
357		Hypothesized response: Linkage record access may change as participant's understanding of the ONA process improves.					
358	2.2.8.1	Data requirement: Number of knowledge base linkage record accesses by each participant in the coalition network over time					
359	2.2.8.1.1	Number of knowledge base linkage record accesses by each participant in the coalition			X		Hourly
360	2.2.9	Measure: Frequency of ONA knowledge base linkage record update					
361		Hypothesized response: Linkage record update may change as participant's understanding of the ONA process improves.					
362	2.2.9.1	Data requirement: Number of knowledge base linkage record updates by each participant in the coalition network over time					
363	2.2.9.1.1	Number of knowledge base linkage record updates by each participant in the coalition network			X		Hourly
364	2.2.10	Measure: Rating of impact of information sharing on selection of DIME options					
365		deleted					
366	2.2.11	Measure: Frequency of ONA knowledge base DIME option record access					
367		Hypothesized response: DIME option record access may change as participant's understanding of the ONA process improves.					

Sequence No.			OBS	SVY	C4I	SCD	Freq.
368	2.2.11.1	Data requirement: Number of knowledge base DIME option record accesses by each participant in the coalition network over time					
369	2.2.11.1.1	Number of knowledge base DIME option record accesses by each participant in the coalition network			X		Hourly
370	2.2.12	Measure: Frequency of ONA knowledge base DIME option record update					
371		Hypothesized response: DIME option record update may change as participant's understanding of the ONA process improves.					
372	2.2.12.1	Data requirement: Number of knowledge base DIME option record updates by each participant in the coalition network over time					
373	2.2.12.1.1	Number of knowledge base DIME option record updates by each participant in the coalition network			X		Hourly
374	2.2.13	Measure: Rating of impact of information sharing on identification of 2nd and 3rd order effects					
375		deleted					
376	2.2.14	Measure: Frequency of ONA knowledge base 2nd and 3rd order effect record access					
377		Hypothesized response: 2nd and 3rd order effect record access may change as participant's understanding of the ONA process improves.					
378	2.2.14.1	Data requirement: Number of knowledge base 2nd and 3rd order effect record accesses by each participant in the coalition network over time					
379	2.2.14.1.1	Number of knowledge base 2nd and 3rd order effect record accesses by each participant in the coalition network			X		Hourly
380	2.2.15	Measure: Frequency of ONA knowledge base 2nd and 3rd order effect record update					
381		Hypothesized response: 2nd and 3rd order effect record update may change as participant's understanding of the ONA process improves.					
382	2.2.15.1	Data requirement: Number of knowledge base 2nd and 3rd order effect record updates by each participant in the coalition network over time					
383	2.2.15.1.1	Number of knowledge base 2nd and 3rd order effect record updates by each participant in the coalition network			X		Hourly
384	2.2.16	Measure: Rating of impact of information sharing on selection of resources					
385		deleted					
386	2.2.17	Measure: Frequency of ONA knowledge base resource record access					
387		Hypothesized response: Resource record access may change as participant's understanding of the ONA process improves.					
388	2.2.17.1	Data requirement: Number of knowledge base resource record accesses by each participant in the coalition network over time					
389	2.2.17.1.1	Number of knowledge base resource record accesses by each participant in the coalition network			X		Hourly
390	2.2.18	Measure: Frequency of ONA knowledge base resource record update					
391		Hypothesized response: Resource record update may change as participant's understanding of the ONA process improves.					
392	2.2.18.1	Data requirement: Number of knowledge base resource record updates by each participant in the coalition network over time					
393	2.2.18.1.1	Number of knowledge base resource record updates by each participant in the coalition			X		Hourly
394	2.2.19	Measure: Rating of impact of information sharing on identification of actions					

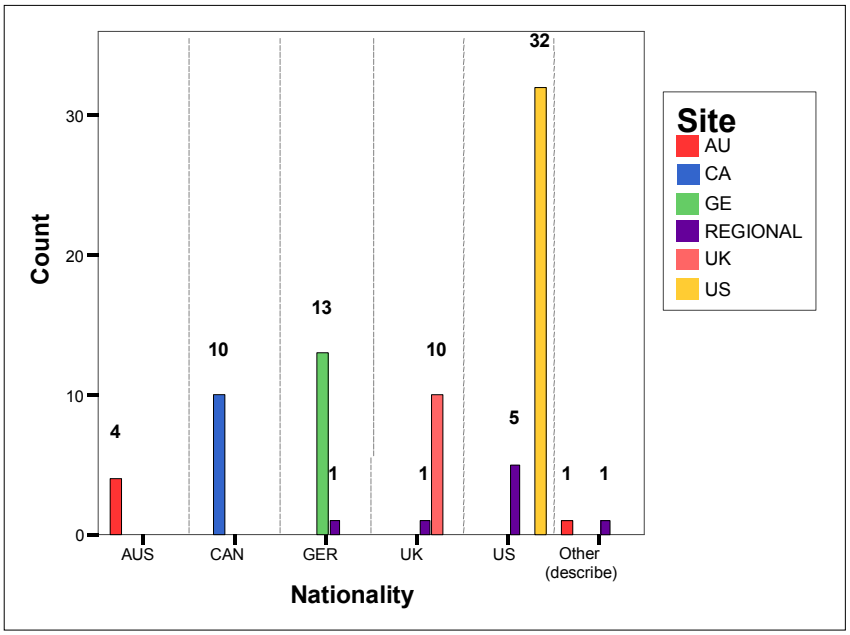
Sequence No.			OBS	SVY	C4I	SCD	Freq.
395		Hypothesized response: Participants will perceive that information sharing enhances the quality of actions identified.					
396	2.2.19.1	Data requirement: User perception of impact of information sharing on identification of actions					
397	2.2.19.1.1	Data element: Survey questions					
398		How often were Effect-to-Node linkages defined clearly enough to easily see the advantages of Action alternatives? (frequency 5 pt)	X	PC			W1 W2
399		How often did different national perspectives enhance the range of Actions available to the coalition? (frequency 5 pt)	X	PC			W1 W2
400		What, if any, were the sources of disagreement among nations concerning Actions?	X	PC			W1 W2
401		How often did your nation refrain from proposing additional Actions to the coalition, in order to protect information? (frequency 5 pt)	X	PC			W1 W2
402		How often did Future information sharing increase the range of Actions available to the coalition? (frequency 5 pt)	X	PC			W1 W2
403	2.2.20	Measure: Rating of impact of information sharing on view of Blue and Red					
404		Hypothesized response: Participants will perceive that information sharing enhances the quality of view of Blue and Red					
405	2.2.20.1	Data requirement: User perception of impact of information sharing on view of Blue and Red					
406	2.2.20.1.1	Data element: Survey questions					
407		In most cases, coalition objectives were sufficiently focused to allow useful views of Blue and Red to be development. (agree scale)	X	PC			W1 W2
408		To what degree did different national perspectives enhance coalition views of Blue and Red? (degree scale)	X	PC			W1 W2
409		What, if any, were the sources of disagreement among nations concerning views of Blue and Red? (narrative)	X	PC			W1 W2
410		How often could your nation have altered coalition views of Blue and Red, but did not in order to protect information? (frequency 5pt)	X	PC			W1 W2
411	2.2.21	Measure: Rating of impact of information sharing on Wargaming					
412		Hypothesized response: Participants will perceive that information sharing enhances the quality of Wargaming					
413	2.2.21.1	Data requirement: User perception of impact of information sharing on Wargaming					
414	2.2.21.1.1	Data element: Survey questions					
415		Coalition views of Blue and Red were comprehensive enough for a thorough exchange of challenges and counter-actions during the Wargaming process. (agree scale)	X	PC			W1 W2
416		How often did different national perspectives enhance the Wargaming process? (frequency	X	PC			W1 W2
417	2.3	**COI: Does the MNIS future operational concept speed up the ONA process?**					
418	2.3.1	deleted					
419	2.3.2	Measure: Rate of change in data records available to each participant in the Coalition Network					
420		Hypothesized response: The future MNIS methods will increase the rate that data in the ONA knowledge base becomes available to participants compared to current information sharing methods.					
421	2.3.2.1	Data requirement: Availability of data to ONA users at each Coalition node over time					
422	2.3.2.1.1	Same data as measure 2.1.1			X		Hourly

Sequence No.			OBS	SVY	C4I	SCD	Freq.
423	2.3.3	Measure: Rating of situational understanding of each participant in the Coalition Network (same as measure 2.1.2)					
424		Hypothesized response: Participant situational awareness will increase over time during an individual trial week, and will further increase when the future information sharing trial is compared to the current method of information sharing trial.					
425	2.3.3.1	Data requirement: Comparison of user perception with ground truth data (Same Ground truth data and Probe Questions as under 2.1.2)					
426	2.3.4	Measure: Rating of difference between Week 1 and Week 2 of the MNIS operational concept on the speed of the ONA process.					
427		Hypothesized response: The future MNIS operational concept will improve the speed of the ONA process.					
428	2.3.4.1	Data requirement: ONA users perception of adequacy of future OPCON in speeding up the ONA process					
429	2.3.4.1.1	Data element: Survey questions					
430		1. Did Week 2 information sharing procedures speed up the ONA process? (yes/no) Please describe.		POC			W2
431	2.4	**COI: Can information releasability procedures keep the ONA data current?**					
432	2.4.1	deleted					
433	2.4.2	deleted					
434	2.4.3	Measure: Rating of difference between Week 1 and Week 2 of ability of information releasability procedures to keep the ONA data current					
435		Hypothesized response: The future MNIS information releasability procedures will improve the ability to keep ONA data current.					
436	2.4.3.1	Data Requirement: User perception of difference between Week 1 and Week 2 of ability of information releasability procedures to keep the ONA data current					
437	2.4.3.1.1	Data Element: Survey questions					
438		1. Information releasability procedures were able to keep the ONA knowledge base current. (agree scale)		COP			W1 W2
439		2. Which information release procedures inhibited your ability to keep the ONA current? (Narrative response)		COP			W1 W2
440		3. Which information release procedures facilitated your ability to keep the ONA current? (Narrative response)		COP			W1 W2

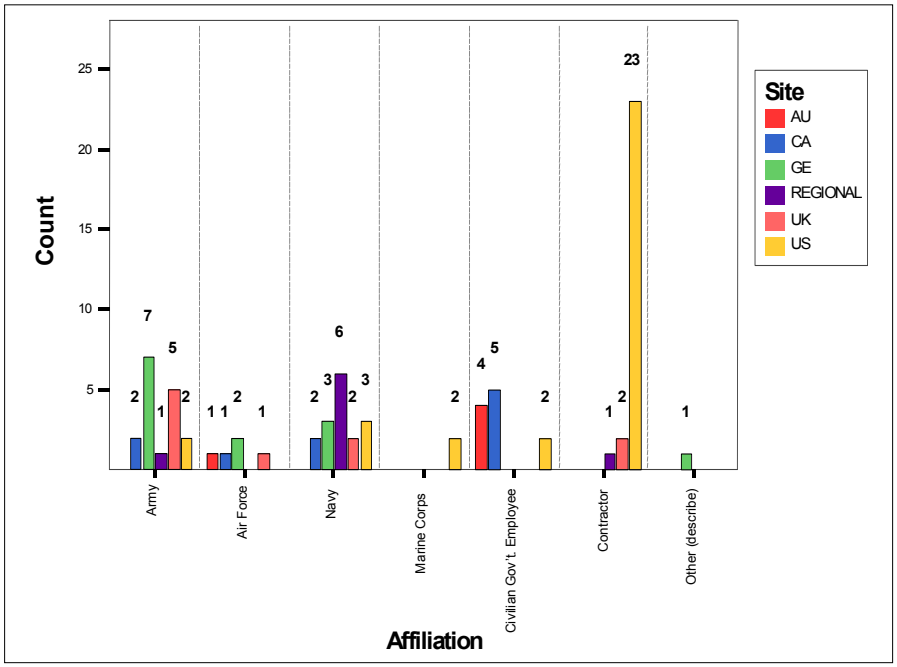
APPENDIX G. MN LOE II DEMOGRAPHICS

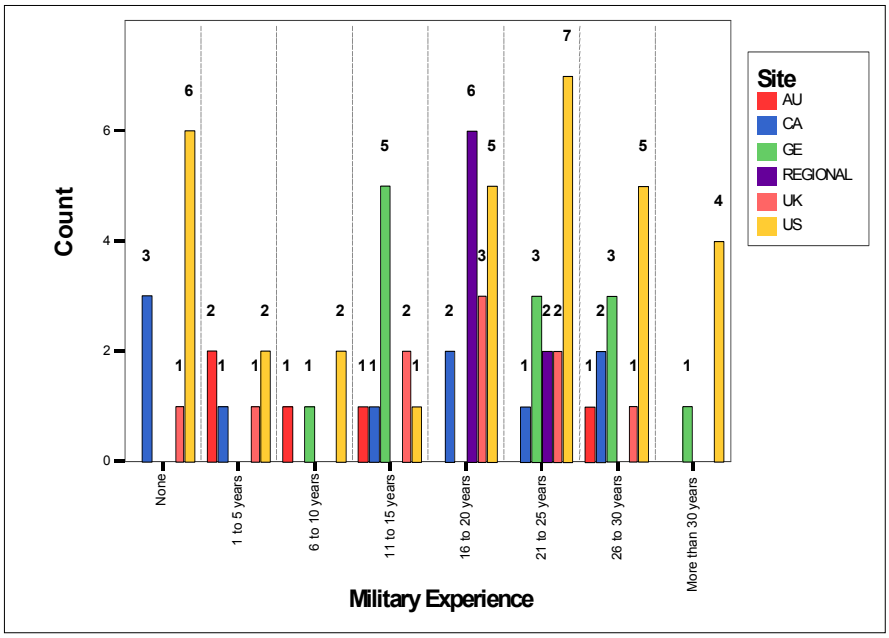
A demographic survey was administered at the end of Week 0 to all experiment participants, as well as to selected controllers and observers, to collect information on the participants' backgrounds, experience, and familiarity with the experiment concepts. Of the 78 respondents, 51 were planners and SoSAs, and 27 were observers and controllers.

This bar chart depicts the nationalities of those surveyed, as well as their experiment site. The smaller bars seen under GER, UK, and US indicate the breakdown of the nationalities for the regional partner, NATO. Two participants indicated a nationality of "other": One was a Polish officer within NATO, and one was a participant with dual citizenship with Australia and the United Kingdom.

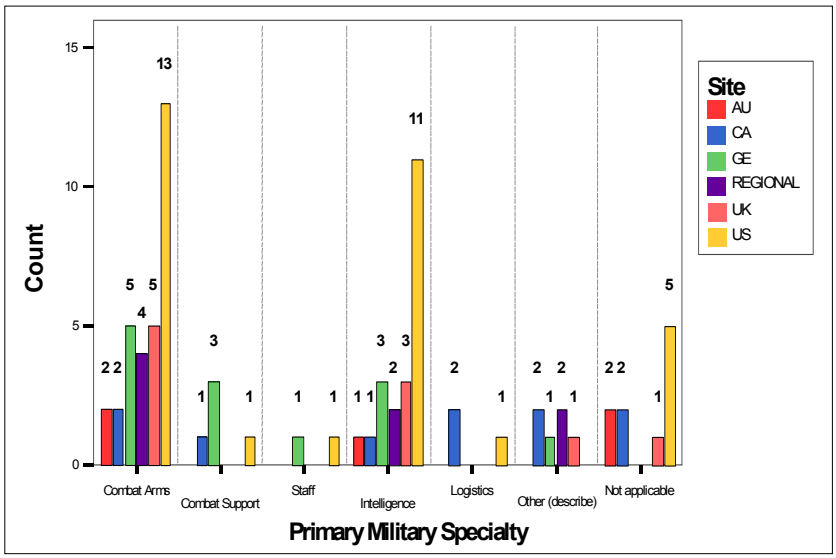


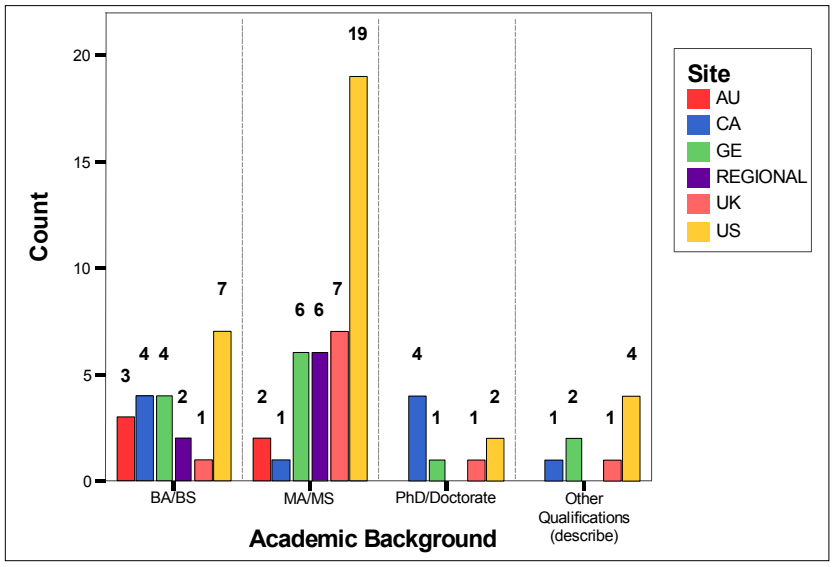
These experienced participants included a large contingent of contractors (33 percent of total respondents, 72 percent of U.S. respondents). Of the 26 contractors who responded, 21 had prior military experience. Of the 11 civilian government employees, six also had prior military experience. In fact, 74 percent of the respondents had more than 10 years of military experience. Of those with military experience, 76 percent specialized in combat arms or intelligence.





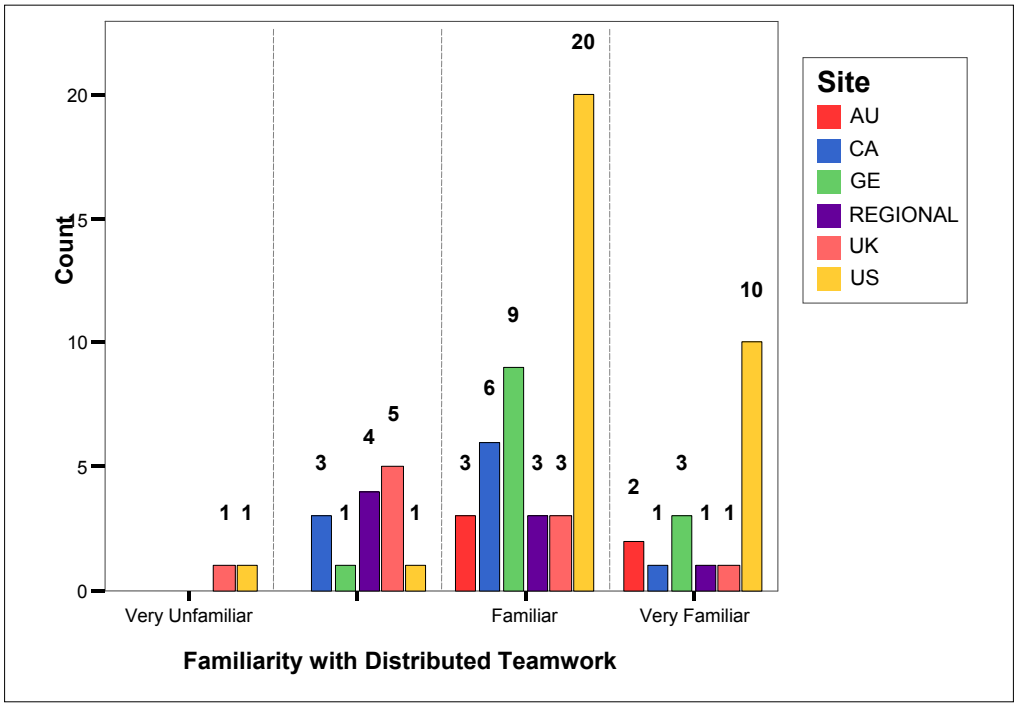
The experiment participants were also well educated. Of the 78 respondents, 95 percent held at least a BA/BS degree or equivalent, and 67 percent held a master's degree or PhD.

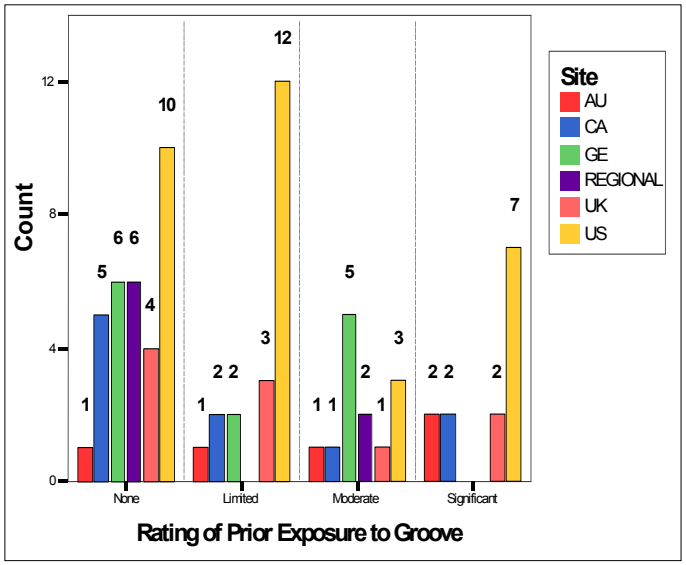


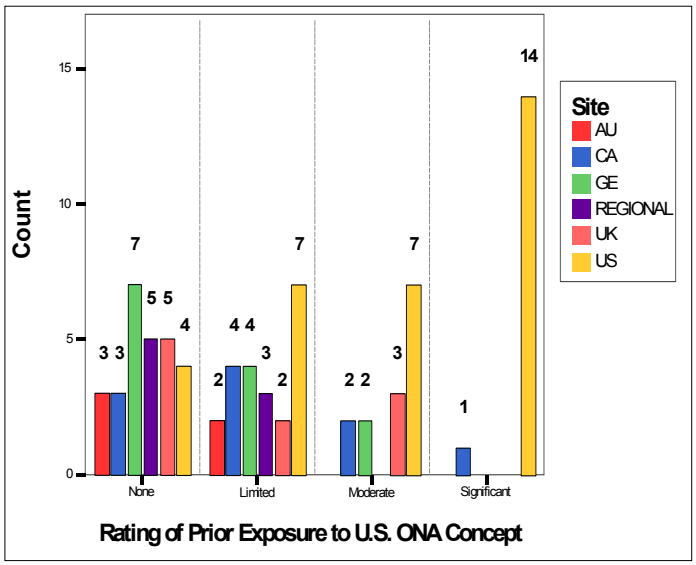


The two primary objectives of this experiment involved (1) examination of the ability of national headquarters staffs to conduct a distributed ONA, and (2) multinational collaborative information sharing across different security domains. To this end, participants needed a familiarity with distributed teamwork, prior exposure to the Groove collaboration tool, and prior exposure to the U.S. ONA concept.

More than 79 percent of the participants rated themselves as familiar or very familiar with distributed teamwork. Only 33 percent had moderate or significant exposure to Groove prior to the experiment; 37 percent had moderate or significant pre-experiment exposure to the U.S. ONA concept. Only 17 percent of the non-U.S. participants had moderate or significant prior exposure to the concept.



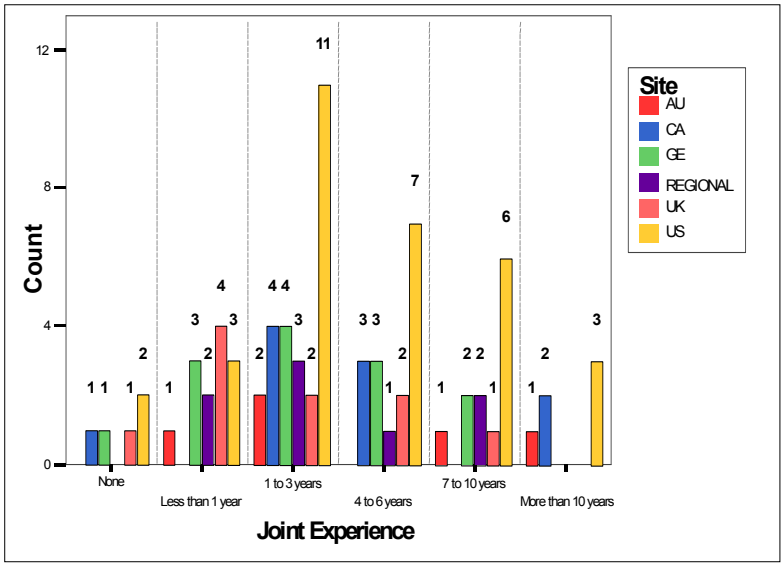


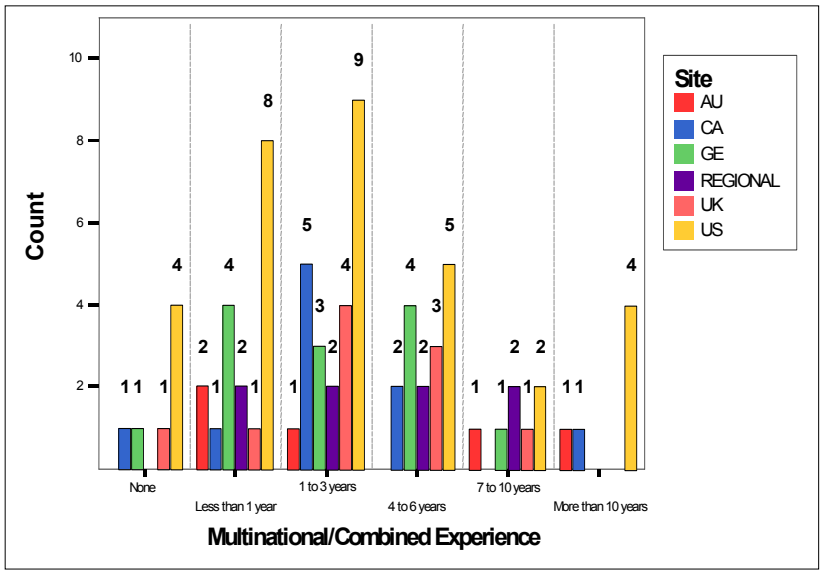


Participant preparation may include previous joint and combined experience, as well as experience with the partner nations in exercises, exchange visits, and social interactions.

Almost 77 percent of the respondents had one or more years of joint experience, and 68 percent had one or more years of multinational or combined experience.

The following charts depict the respondents' experience in combined exercises, exchange visits, and social interactions with each of the partner nations.


Count
Site
AU
CA
GE
REGIONAL
UK
US
None
Less than 1 year
1 to 3 years
4 to 6 years
7 to 10 years
More than 10 years
Joint Experience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GE
REGIONAL
UK
US
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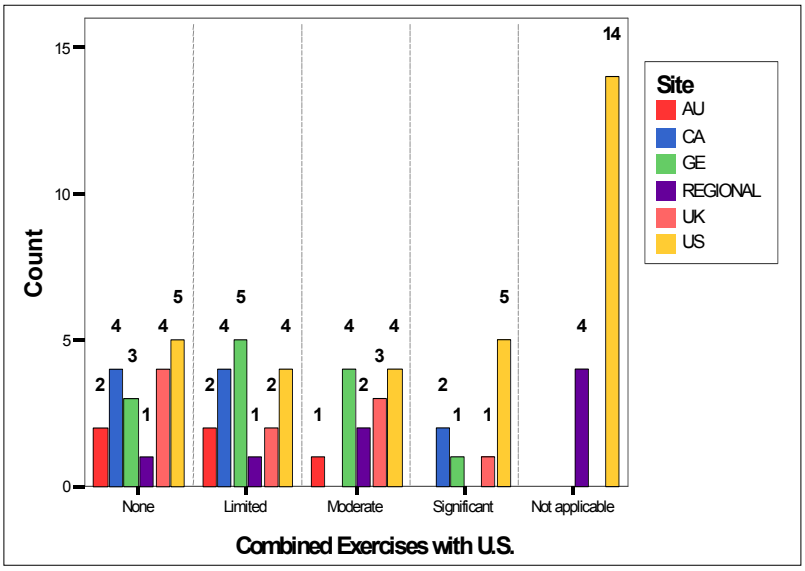
Less than 1 year
1 to 3 years
4 to 6 years
7 to 10 years
More than 10 years
Multinational/Combined Experience


Count
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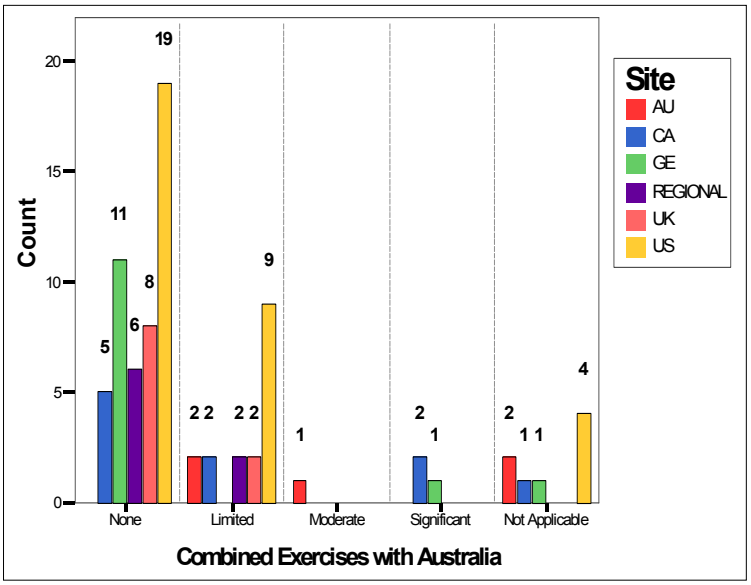
GE
REGIONAL
UK
US
None
Limited
Moderate
Significant
Not applicable
Combined Exercises with U.S.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Count
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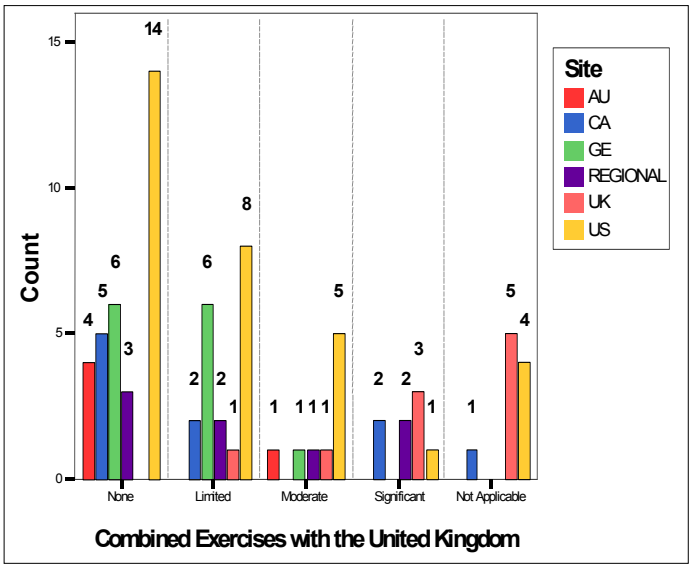
Significant
Not Applicable
Combined Exercises with Australia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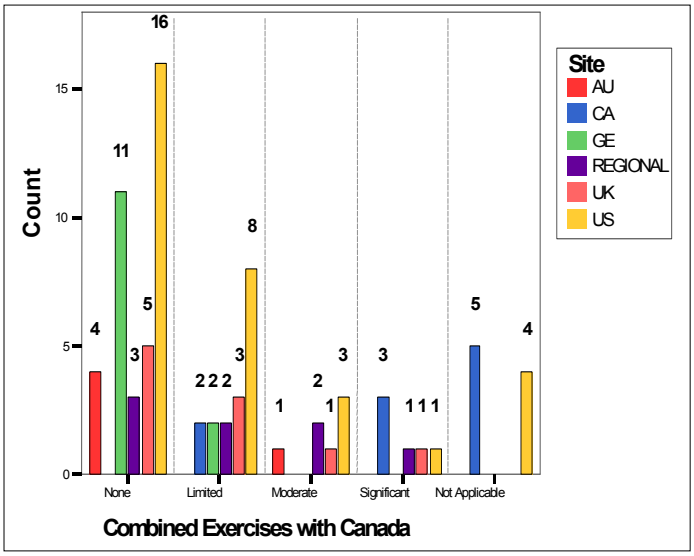
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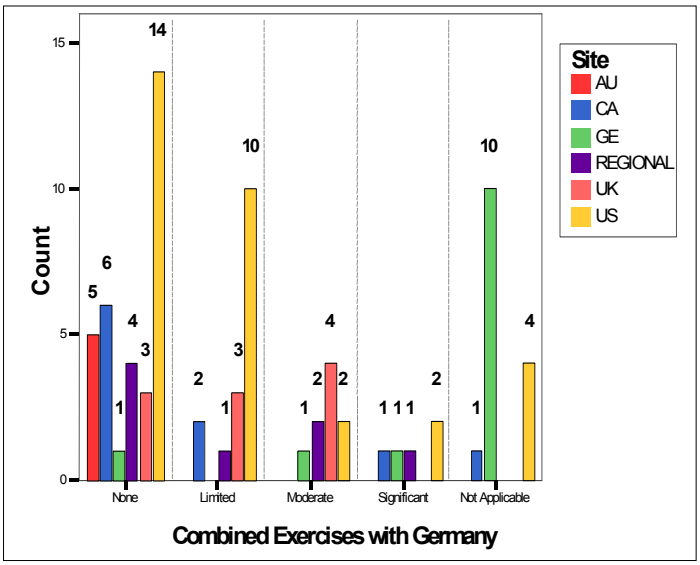
Combined Exercises with Canada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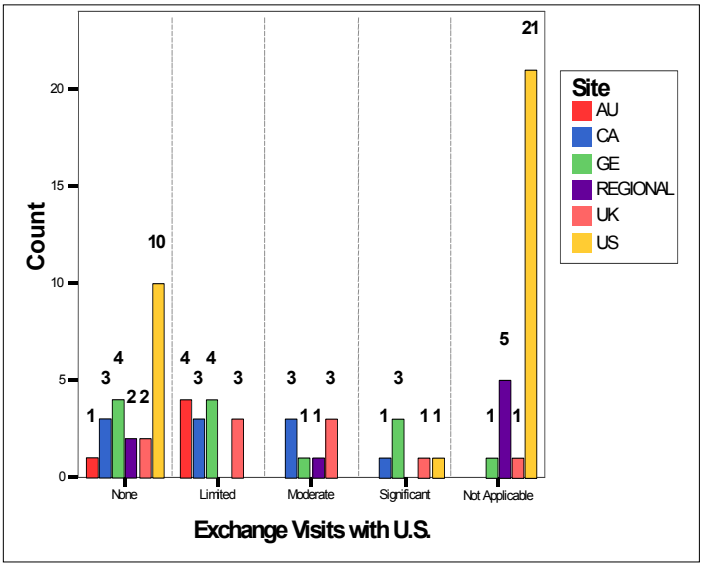
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Count
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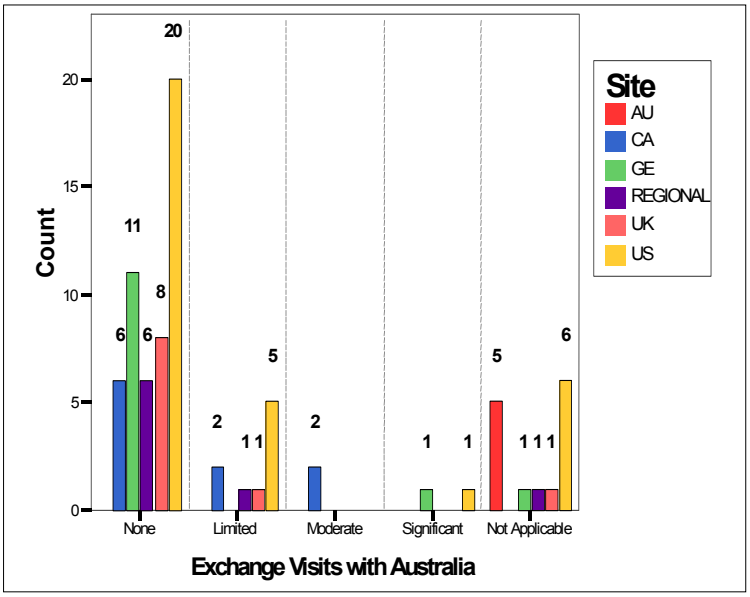
Significant
Not Applicable
Exchange Visits with U.S.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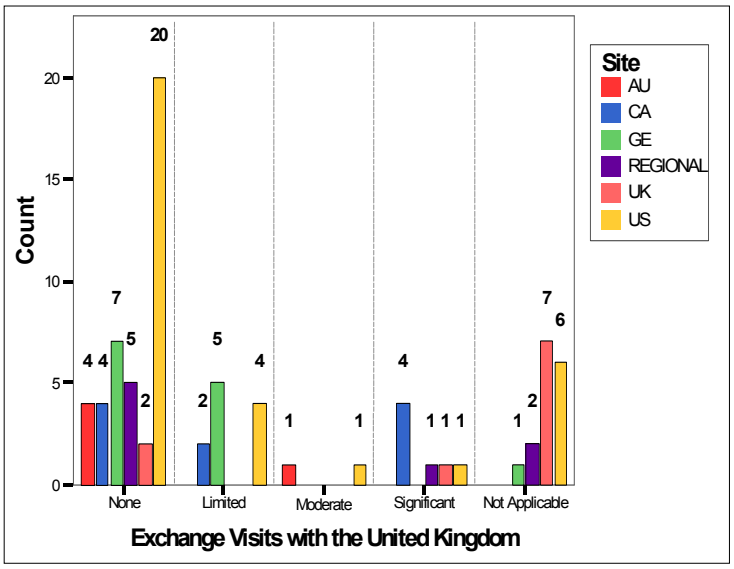
Exchange Visits with Australia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Count
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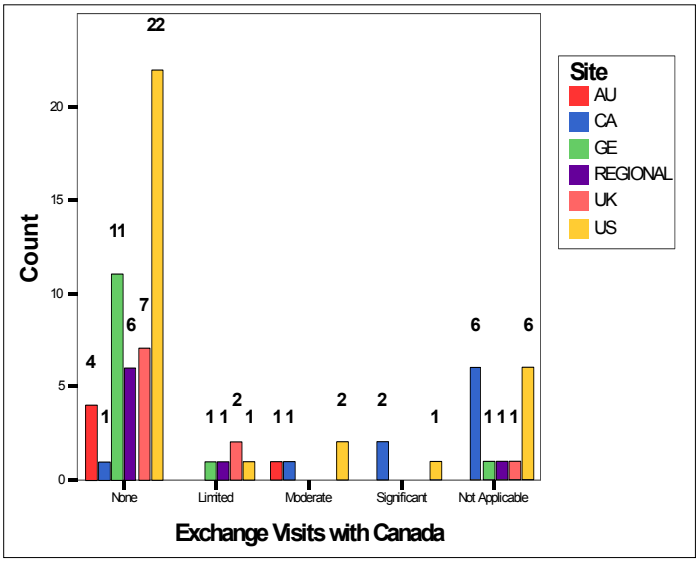
Moderate
Significant
Not Applicable
Exchange Visits with the United Kingdom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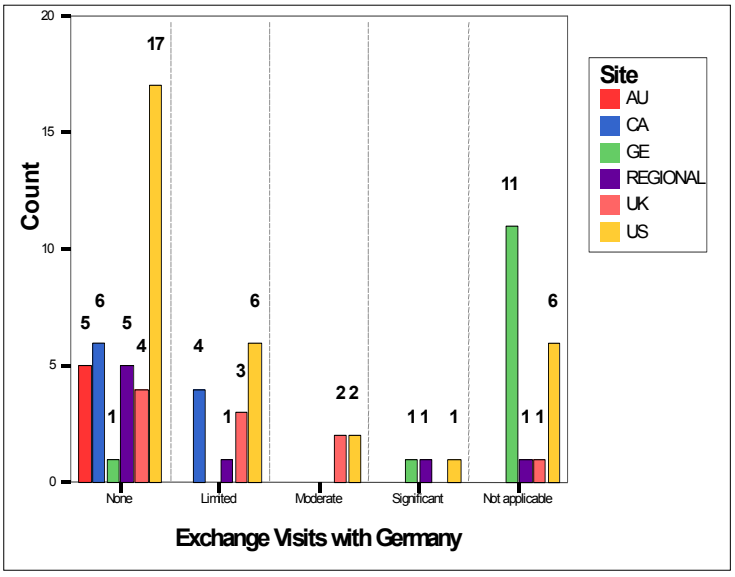
Exchange Visits with Canada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Count
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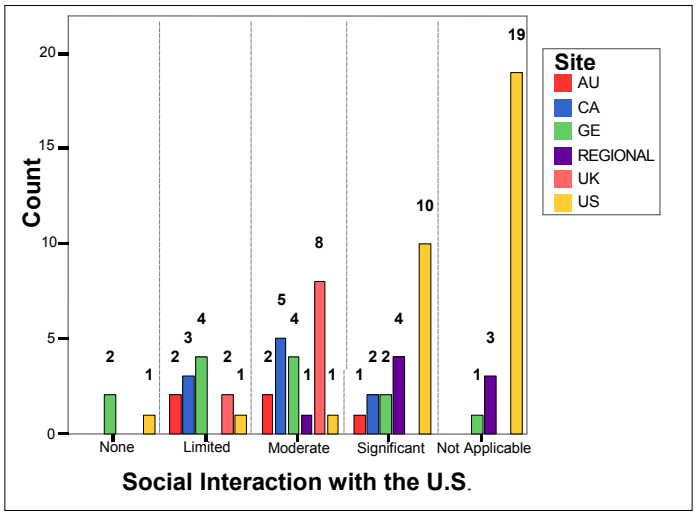
Significant
Not applicable
Exchange Visits with Germany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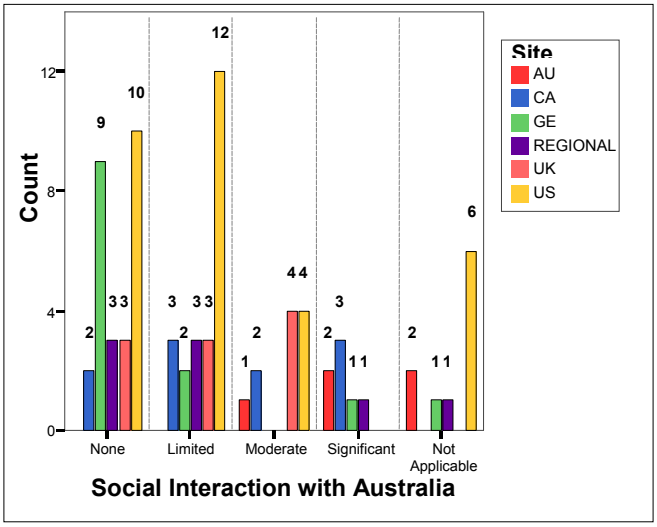
Limited
Moderate
Significant
Not Applicable
Social Interaction with the U.S.


Count
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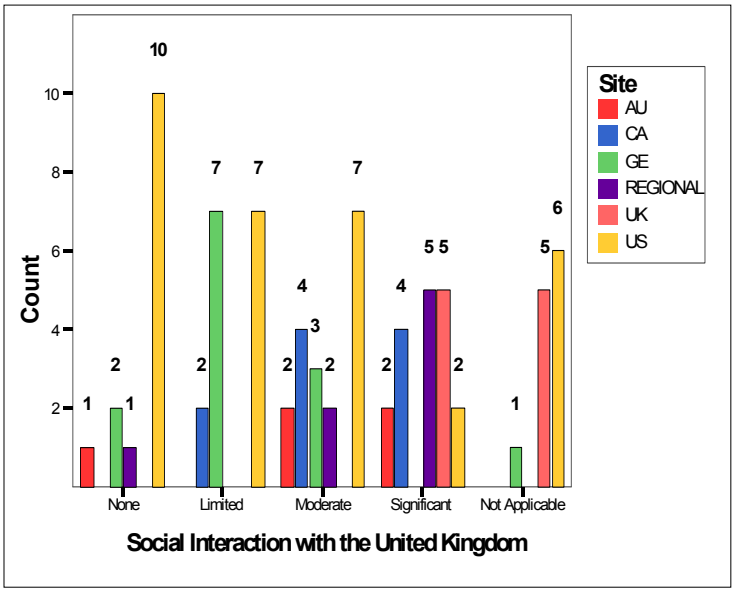
Social Interaction with Australia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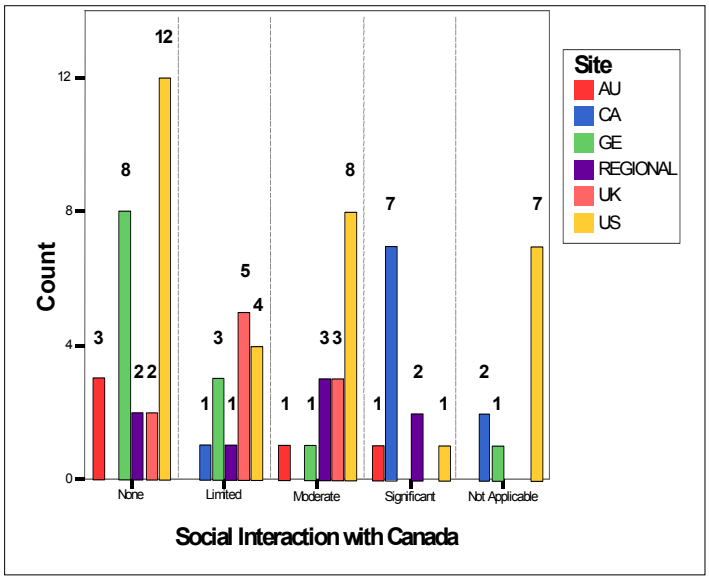
Not Applicable
Social Interaction with the United Kingdom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12
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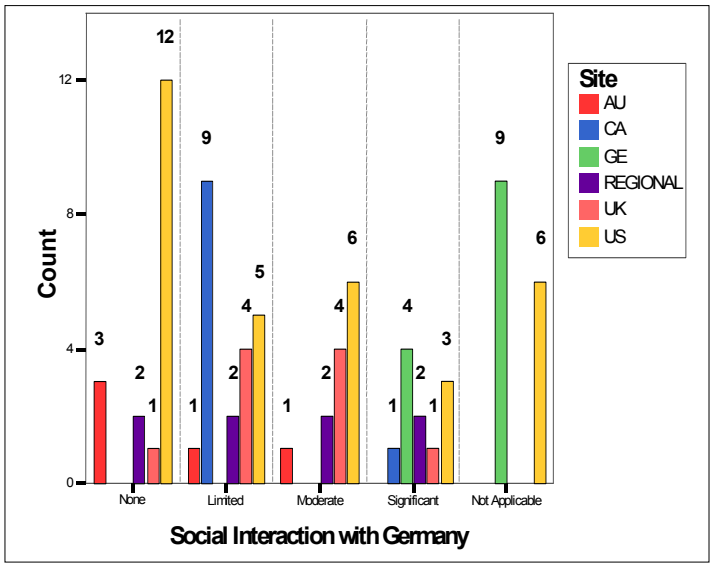
Moderate
Significant
Not Applicable
Social Interaction with Canada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Count
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Moderate
Significant
Not Applicable
Social Interaction with Germany

APPENDIX H. ANCILLARY LESSONS LEARNED

The lessons learned were categorized as main experimental lessons learned and ancillary lessons learned. The main lessons learned aimed to facilitate the successful completion of the next multinational experiment. After those lessons are implemented, or possibly at the same time, the ancillary lessons learned should be implemented if time and resources permit. See Chapter V, Experimental Process Lessons, for more information.

Lessons learned are presented in this format:

Title of Lesson Learned:

- Observation: This is the point of concern.
- Discussion: The discussion expounds upon the observation and gives more background into the potential problem or solution.
- Lessons Learned: What was learned from the observation that was made?
- Recommendation: What is the recommendation for future experimentation?

TECHNOLOGY

Title: Network Server Location

- Observation: Servers were not positioned to provide optimum service.
- Discussion: The U.S. Groove Relay Server and the ONADB Server were located on a subnet at the U.S. site, where a loss of the U.S. CFBL net point of participation would deny service to all other sites. During MN LOE II, the U.S. site lost CFBL net connectivity, denying most overseas sites access to the relay server and, more importantly, to the ONADB server. Australia was not affected.
- Lesson Learned: Proper design and placement of servers can ensure equal access from all sites.
- Recommendation: The architecture of servers for the experiment should consider the underlying network topology, services required, individual national issues, and associated costs.

Title: Training

- Observation: The training provided during Week 0 was not sufficient for the players even though prior exposure had been obtained in both the concepts and tools used.
- Discussion: The training provided during Week 0 suffered from these major problems:
  - Method of delivery, using Groove, and poor audio quality
  - Lecture style of presentations
  - Inability to engage with the training/lecturing staff
  - Lack of training materials
  - Lack of a training vignette as part of the experiment.

- Lesson Learned: New concepts and using technologies with which the operators are unfamiliar require an investment in the training of the operators. Training while experimenting is not acceptable.
- Recommendation: Invest in a training program and schedule.

Title: ONA Geographic Visualization Tool

- Observation: The ONA geographic visualization tool requires further refinement in order to effectively display data from the ONA database. The geographic display of information contained in the ONA database was inadequate for an ONA. Because government-produced charts were not available for use, the display did not meet the limited standards established in the pre-experiment planning meetings.
- Discussion: The digital maps did not contain current geophysical or cultural information in the detail and scales necessary for system-of-systems analysis or operational planning. Within the context of this experiment, the exact charts of the area of interest were not released. However, symbols used on the maps to indicate the location of nodes did not follow standard military or cartography use and did not include a key to explain the symbols, which were different from those agreed upon at pre-experiment planning meetings. Standardization was needed for the symbols used.
- Lesson Learned: The foundation of the ONA database is reliable, current, and accurate information, regardless of form (words, pictures, charts, maps). This information is needed for the preparation and use of the ONA database. Symbols must conform to national standards, and a legend should be provided.
- Recommendations:
  - The users of the ONA database should meet to establish requirements for the graphic display.
  - Use standard symbols for annotating the graphic visualization tool, and provide a legend.
  - JFCOM J2 and J9 personnel should work with NIMA to ensure that current and accurate digital charts and maps are available on demand for all parts of the world.

Title: Replication or Modeling of Future Technologies

- Observation: Groove was unable to support all of the functionality necessary to replicate the CIE capability.
- Discussion: Experimentation required current technology in order to replicate the capabilities of technologies of the future. If that were truly possible, they wouldn't be technologies of the future, but rather, technologies of today. However, the characteristics of a projected future technology may be replicated.
  - What does the technology of the future enable us to do that we cannot do today?
  - How can those characteristics be replicated?

- Must all of the characteristics of the future be in one package or resemble the technology of the future? Indeed, maybe the solution is to use more basic, but proven, capabilities that can accurately emulate characteristics desired. Otherwise, experiments are conducted within experiments. If one fails, then it has the potential to affect the other negatively.

- Lesson Learned: Stick with basic, but proven, capabilities for large collaborative groups that can accurately emulate characteristics desired for the projected future technologies.
- Recommendation: Identify those characteristics of technology that aren't currently available, then determine and implement tested and true techniques for replicating them.

Title: Setup of Participant Accounts

- Observation: Technical requirements for participant setup actions must be linked directly with the manning document.
- Discussion: Setting permissions and access restrictions occurred four separate times for this event. Twenty shared spaces and several database permissions needed to be set for each of more than 180 participants, resulting in nearly 60,000 permissions decisions during account setup. The effect of tackling this exercise four times was mind-boggling. This experience can be directly attributed to the ever-changing manning document, all the way up to the commencement of the experiment. Most of the difficulties stemmed from constant changes in the player list. U.S. personnel had to make their best educated guess in order to begin the experiment, and then they modified the manning document as changes occurred. Additionally, a problem within the servers or the software complicated the matter. Information was input but did not take effect or changed overnight on several occasions.
- Lesson Learned: Technical and concepts personnel must agree on the data needed for setting up participant accounts and must link that information to the master participants' manning document. Additionally, this task must be done in a coordination mode rather than a control mode. The work must be distributed.
- Recommendation: Integrate technical requirements needed to set up accounts for participants with the event-manning document, so that event setup requirements are clear. The matrix used to build the participant list should include fields for individual user accounts and permissions. In past experiments, the information manager performed this key integration.

Title: ClearResearch as a Tool for System-of-Systems Analysis

- Observation: To determine if the program should be adopted as a tool for the SoSA portion of developing an ONA, U.S. SoSAs evaluated ClearResearch so that it would not interfere with the primary objectives of MN LOE II.
- Discussion: The evaluation plan for ClearResearch called for selected PMESII analysts, trained in this tool, to conduct searches in order to create or update nodes. The performance of ClearResearch was evaluated by its ability to

create or update nodes. Immediately after the experiment, PMESII analysts used ClearResearch to create nodes that could have been added to the database during the experiment, creating a larger sample size for the evaluation. Information provided by ClearResearch was evaluated using a survey created by the PMESII analysts. The total sample size—during and after the experiment—was 74. Survey responses from the PMESII analysts showed that the relationship or category map was not useful 37.5 percent of the time.

- Lesson Learned: Based on this limited trial, ClearResearch did not prove to be sufficiently dependable or useful to PMESII analysts who conducted the specific task of research for the SoSA portion of developing an ONA.
- Recommendation: More research is required on ClearResearch in order to fully evaluate it. Additionally, alternative options for SoSA research tools should be explored.

INFORMATION SHARING

Title: Linking the MNIS OPCON to SJFHQ

- Observation: In the USJFCOM J6 operational concept, "Multinational Information Sharing for Allies and Coalition Members," the CISP3 is introduced as an integral part of the standing joint force headquarters component of any national military force. However, the document does not address how the CISP3 is integrated into the SJFHQ. Nor does the paper consider alternative, non-U.S.-based polices and procedures for sharing information in multinational operations.
- Discussion: Is the CISP3 a board, a center, or a cell, and/or how does it fit into the operations/planning process? Additionally, no membership is described for the CISP3. Does it include members from all the SJFHQ groups, such as operations, plans, and information superiority? The J6 document also heavily implies a foreign disclosure role within the CISP3. Under the current manning roster of the SJFHQ, no foreign disclosure officer billets exist. The MNIS document also does not adequately describe foreign disclosure roles and responsibilities within the CISP3.
- Lessons Learned: The CISP3 OPCON must be revised.
- Recommendation: USJFCOM J6 must revisit and refine the description, roles, and responsibilities of the CISP3 and must explain how the CISP3 becomes an integral part of the SJFHQ.

Title: U.S. National Disclosure Policy (NDP-1)

- Observation: U.S. policy NDP-1 does not afford commanders the flexibility necessary to share information during pre-crisis.
- Discussion: The policy is intended to be restrictive; thus, the U.S. *shares* information by exception. Coalition information sharing requires a policy that *withholds* information by exception. Information sharing in the context of

effects-based operations exists on two plains: blue forces' view of red forces, or information about the adversary, and blue forces' view of blue forces, or information about one's own capabilities and force disposition. Information about blue force capabilities is controlled by the Secretary of Defense and operational commanders and carries significant operational security and force protection implications. Policies enforced during actual operations also must apply to pre-crisis situations and, to a certain extent, to experimentation. Currently, none of the policies address experimentation, thus making the process extremely difficult.

- Lessons Learned: The current sharing policy is not compatible within a multinational collaborative environment. Both of the information-sharing realms must be addressed, demanding high-level coordination with the intelligence and military operations communities.
- Recommendation: To acknowledge the information age and the necessity to share rather than withhold information, request a serious, detailed examination of NDP-1 and associated implementing directives.

COLLABORATION

Title: Experiment Constraints

- Observation: Experiment design and time constraints limited awareness of the complexity of the ONA process and allowed non-database means for conducting the ONA. The experiment constraints—consideration of only five nodes per effect and time limit—restricted the completeness of the analysis.
- Discussion: These limitations did not give participants an appreciation of the potential complexity and richness of the analysis. Experiment constraints also allowed the use of non-database tools to propose linkages and to present the results. To overcome this limitation, the U.S. SoSA team suggested that the fourth vignette be replaced with the detailed ENAR linkage of a single directed effect by all participants. This allowed analysts and planners to examine nodes from all PMESII categories, to fully explore linkages and all actions in all phases, and to use a wide range of national resources.
- Lesson Learned: Experiment and time constraints limited the ability of participants to fully use the ONA process and ONA database and tools.
- Recommendation: Future experiments should provide participants with a large, detailed ONA and sufficient work hours to complete the analysis. This would drive participants to use ONA database capabilities to create the linkages. The ONA graphical layout tool should be used to view and present the linkages, nudging ONA participants away from non-database procedures to those using an automated ONA database.

Title: CIE Concept

- Observation: Even though the CIE concept was not tested within this LOE, it was still the subject of observations resulting from the collaborative

environment used to develop the ONA. U.S. senior concept developers (SCDs) suggested that the CIE concept fails to address the knowledge and leadership aspects of ONA and EBO.

- Discussion: SCDs noted the failures of the CIE concept in detail. A good definition of collaboration does not exist, nor does a clear understanding of it. The concept addresses the common relevant operational picture, joint interactive planning, and the global information grid, but it does not illustrate how these components build knowledge. Further, the different demands that CIE places on leadership require greater emphasis.
- Lesson Learned: The CIE concept needs further work.
- Recommendation: Reemphasize and rewrite the CIE white paper to incorporate the lessons learned from this LOE, with an emphasis on the knowledge and leadership aspects of CIE.

EXPERIMENT DESIGN

Title: Leveraging Other Multinational Endeavors

- Observation: Some of the challenges of this experiment have been explored by the joint warrior interoperability demonstration (JWID).
- Discussion: While not an experimentation effort, JWID addressed the multinational collaborative tool issue. Artificial geographies and histories have been created for JWID. Additionally, most of those involved in the multinational experimentation effort participate in JWID. In the past, JWID has been nothing more than a technology demonstration where vendors display their wares and had nothing to do with future combat capabilities. J9 reviewed the JWID 03 plan and determined they would not participate. JWID 04 may offer another opportunity to explore; however, the event is focused on Northern Command and therefore may not be valuable for multinational partners. J9 remains in contact with JWID organizers.
- Lesson Learned: Much of the work from JWID and other multinational endeavors may reduce manpower efforts on this end, as well as training requirements on the other end.
- Recommendation: In the future, explore multinational endeavors, including JWID, to identify elements to be used for experimentation efforts.

Title: Requirements Collection and Tool Selection

- Observation: The selection of tools for MN LOE II did not result from the collection of requirements to support the operational concepts.
- Discussion: The tools were selected to explore fully the capabilities of peer-to-peer technology. However, the lack of an effort to collect and develop requirements to support operational concept implementation resulted in insufficient tool capabilities to conduct the process effectively. Thus, collaboration capability and ONA database functionality were not optimal.

- Lesson Learned: Requirements must be defined prior to tool selection, so that essential capabilities can be addressed and problems can be resolved or avoided during process employment.
- Recommendation: Future experiment efforts should demand the collection of requirements prior to tool selection in order to support operational concept employment functionality.

Title: Role of Liaison Officers (LNOs) in Experiment Planning and Execution

- Observation: LNOs solved or prevented several problems, decreasing the overall demand on technical and control elements.
- Discussion: Since habitual relationships breed familiarity, trust, and cohesion, a single point of contact ensures that all of a nation's concerns are addressed. Additionally, by selecting LNOs with diverse backgrounds and expertise, a de facto alternative experiment control was created. Moreover, LNOs who were engaged throughout the planning process were more likely to identify the correct problem solver. An LNO's greatest value is to serve as a translator of sorts—to be able to say, "Here's what they said, now here's what they meant."
- Lesson Learned: The presence of LNOs throughout the planning and execution phase is critical. LNOs with a diverse background who have been cross-trained are most useful.
- Recommendation: Continue to use LNOs in multinational experimentation efforts. Select the LNOs early in the process to maximize the time needed for familiarity, trust, and cohesion to grow. Select LNOs with diverse backgrounds, including technical and conceptual backgrounds, and cross-train them to the maximum extent practicable. Also, consider extending the LNO concept to allow an exchange—rather than U.S. placement—of LNOs in future events.

Title: Information Manager Usage

- Observation: An information manager would have helped immensely in preparing and executing this event. The operational net assessment and coalition information-sharing processes were hampered due to a lack of knowledge management principles in their processes.
- Discussion: In past events, an information manager kept a log of significant events, kept the event rolling, and generally assisted the chief controller with event organization. During pre-event operations, the information manager would coordinate setup details, would assist the chief controller with contingencies, and would interface with other key players. A knowledge or information management plan would have greatly reduced the general confusion among the experiment participants about document management, collaboration processes, and information-sharing practices.
- Lesson Learned: An information manager enhances all elements of execution. Lack of knowledge managers and of a knowledge management plan will inhibit operational process refinement experiments.
- Recommendation: Knowledge management personnel must participate with the national teams and a knowledge management plan must exist for future experiments. The information manager should be a required position for all events.

Title: Interagency Participants

- Observation: Interagency participants are needed to fully examine the ONA process. Most participants from multiple countries were affiliated with the military.
- Discussion: Lack of interagency participants limited the consideration of diplomatic and political actions and resources. Most military members do not have the breadth of experience in nonmilitary agencies nor the capability to identify nonmilitary aspects of the ONA. Participant nations' militaries have been working together so closely and for so long that a significant cultural difference may not exist in the group's professional approach to developing the ONA. The cultural variances among military personnel from different nations may be less pronounced than those between military and political personnel within nations.
- Lesson Learned: Solely military-affiliated experiment participants do not provide a sufficient breadth of knowledge or experience to fully perform an ONA.
- Recommendation: In order to fully build an ONA, interagency participants are required from each of the countries involved.

Title: Release/Disclosure of Geospatial Information and Services Products

- Observation: Several obstacles were encountered in obtaining authorization to disclose or release National Imagery and Mapping Agency (NIMA) data for the MN LOE II play box.

- Discussion: In the planning phases of MN LOE II, the play box was identified in order to begin crafting the scenario and building knowledge of the area. Since the experiment was a multinational event, appropriate geospatial information and services were available and releasable to the multinational participants. Ultimately, only some products could be released to multinational participants; however, those released were sufficient to conduct the experiment. Within the process, a minimum of information was needed to submit a request for disclosure or release authorization:
  - Purpose: Will the products be used for exercise or experiment?
  - Participants: Identify the multinational participants and observers who will require access to the products.
  - Mapping Products: Identify the sheet numbers and series, or other GIS product data, including the specific scale.
  - Timeline: Identify the time frame of the event. Consider planning conferences and pre-event workshops in determining when the information is sought.
  - Release or Disclosure: Specifically, will the products be released, or "given," to the multinational participants to keep, or will they be simply disclosed, or "displayed," to the participants?
  - Product Control
- Lesson Learned: A detailed request for disclosure or release must be submitted early in the planning phases. Final authorization to disclose and/or release NIMA limited-distribution data is the responsibility of the NIMA disclosure and release office. In addition, multinational event planners must maintain close and continuing coordination among themselves, the USJFCOM foreign disclosure officer, and the command's NIMA liaison officer.
- Recommendation: A coordination effort for release of NIMA limited-distribution data should begin immediately after the scenario play box has been identified, after the initial planning conference. Additionally, frequent communication is required with agencies and offices involved in the request process to reconcile the status of any requests.

Title: Classification Guidance

- Observation: The discussion and decision regarding classification guidance for MN LOE II was a long, involved process that required insights and input from all of the multinational partners.
- Discussion: While information related to the scenario was classified, the actual information used to construct the ONA database and the attendant scenario was unclassified. Accordingly, the risk of inadvertent release or disclosure or possible security violations was minimal, resulting in no urgency to decide classification guidance before research began for the ONA database. In subsequent and succeeding experiments, these artificialities may not be present. In reality, classification guidance should be promulgated to all participants prior to database and scenario development. New ONA database

development from scratch is time-consuming and manpower-intensive, and requires much lead-time.

- Lesson Learned: Given the prolonged ONA database development, classification guidance must be determined early in the planning process—by the concept development conference, if possible—to enable work to commence on the scenario and database.
- Recommendation: Develop and promulgate to all participants standard classification guidance for the experiment early in the planning process, and do not deviate from that guidance, except under extreme circumstances.

Title: Senior Concept Developer (SCD) Pre-Event Caucus and Orientation

- Observation: Use of SCDs who met prior to the LOE to address main objectives and associated issues contributed significantly to the LOE breadth.
- Discussion: The insightful opinions of SCDs are a proven added value to any experiment on military concepts, especially when introducing U.S. concepts to a multinational audience. Bringing the SCDs together for a face-to-face orientation allowed them to focus on the right issues during the LOE. Since they had met prior to the event and had been introduced to the LOE background and objective, the SCDs were more candid in their comments during the azimuth checks and in-focus sessions.
- Lesson Learned: SCD pre-event caucus and orientation significantly increase the contributions of SCDs.
- Recommendation: Plan an SCD pre-event caucus and orientation to focus the SCDs on the event objectives and issues.

APPENDIX I. ACRONYMS AND ABBREVIATIONS

AAR – After Action Review
ARL – Army Research Laboratory
AUS - Australia
BL1 – Bilateral 1
BL2 – Bilateral 2
CAN – Canada
CBIS – Content Based Information System
CC – Control Cell
CCEB – Combined Communications-Electronics Board
CCIB – Command and Control Interoperability Board
CD – compact disk
CDC – Concept Development Conference
CDE - Concept Development and Experimentation (NATO SACLANT)
CDR USPACOM – Commander, United States Pacific Command
CFBLNet - Combined Federated Battle Laboratories Network
CFEC - Canadian Forces Experimentation Centre
C4I – Command Control Communications Computer and Information
CIE – Collaborative information Environment
CISP3 - Coalition Information-Sharing Policy and Procedures Panel
COA – Course of action
COI – Critical Operational Issue
CONOPS – Concept of Operations
CWC - Chemical Weapons Convention
DIME – Diplomatic, Information, Military, Economic
DOTMLPF – Doctrine, Organization, Training, Materiel, Leadership Development, Personnel, and Facilities
DSTL - Defence Science & Technology Laboratory
DSTO - Defence Science & Technology Organization
EBO – Effects Based Operations
EEZ - Exclusive Economic Zone
ENAR – Effects, Nodes, Actions, Resources
EU – European Union
FDO – Foreign Disclosure Officer
FFG – Guided missile frigate
GER – Germany
GL – Graphical Layout
GT – Gross tons
HF – Human Factors
IDP - Internally displaced persons
IM – Information Manager
IOM - International Organization for Migration
IP – Internet Protocol
IS – Information sharing
JBC – Joint Battle Center
JDCAT – JBC Data Collection and Analysis Tool
JIACG – Joint Interagency Control Group
JROC – Joint Requirements Oversight Council
JWICS – Joint Worldwide Intelligence Communications System
JWID – Joint Warrior Interoperability Demonstration
KM – Knowledge Manager
LNO – Liaison officer
LOCE – Linked Ops-Intel Centers Europe
LOE – Limited Objective Experiment
Mbps – Megabytes per second
MIC – Multinational Interoperability Council
ML – Multilateral
MLS – Multi-Level Security
MN - Multinational
MNC - Multinational Corporation / Multinational Conglomerate
MNIS – Multinational Information Sharing

MNISACP – MN Information Sharing for Allies and Coalition Partners
MOA – Memorandum of Agreement
MOU – Memorandum of Understanding
MSEL – Master Scenario Events List
NATO – North Atlantic Treaty Organization
NDP – National Disclosure Policy
NGO – Non-governmental organization
NIMA – National Imagery and Mapping Agency
NIPRNET – Non-secure Internet Protocol Router Network
NM – Nautical mile
NSA – National Security Agency
ONA – Operational Net Assessment
ONA GL – Operational Net Assessment Graphical Layout tool
OPEC – Organization of Petroleum Exporting Countries
OPCON – Operational Concept
PMESII – Political, Military, Economic, Social, Infrastructure, Information
POP – Point of Participation
P2P – Peer to Peer
RF – radio frequency
SA – Situational Awareness
SACLANT – Supreme Allied Commander Atlantic
SCD – Senior Concept Developer
SIPRNET – Secret Internet Protocol Router Network
SJFHQ – Standing Joint Force Headquarters
SLOC – Sea Lines of Communication
SME – Subject Matter Expert
SoSA – System-of-System Analyst
SPSS – Statistical Product and Service Solutions
SQL – Structured Query Language
SWA – Southwest Asia
SPAWAR – Space and Naval Warfare Systems Command
TL – Trilateral
TTPs – Tactics, Techniques, and Procedures
U - Unclassified
UK – United Kingdom
UNHCR - UN High Commissioner on Refugees
US – United States
USJFCOM – United States Joint Forces Command
VIP – Very Important Person
WAN – Wide Area Network
WS - workshop
ZULU – Time zone indicator for Universal Time

APPENDIX J. CONCEPT OVERVIEWS

Operational Net Assessment

Operational net assessment (ONA) is the integration of people, processes, and tools that use multiple information sources and collaborative analysis to enhance command decision-making. This continuous, dynamic process produces a coherent, relevant, and shared knowledge environment, as well as supporting tools, for planners and decision-makers to focus warfighting capabilities.

In addition, ONA is the catalyst for battlespace understanding that enables *decision superiority*—the effective and timely decisions that ensure mission success. ONA uses collaboration technologies and subject matter expertise to transform data into useful information, which, in turn, becomes actionable knowledge.

With the ONA concept, U.S. Joint Forces Command is leading the effort to build the knowledge environment our national leaders and multinational partners need to execute an effective strategy that employs all elements of our combined power.

The ONA process frames our understanding of a potential adversary's political, military, economic, social, information, and infrastructure (PMESII) systems. Link analysis, network analysis, and structured argumentation are used to assess the adversary's systems.

Such systems analysis:

- Reveals critical nodes and vulnerabilities that can be used in effects-based operations
- Recognizes the adversary's goals, intentions, strengths, weaknesses, and behaviors
- Generates understanding and knowledge that may be used to predict indirect and unintended effects a of diplomatic, information, military, or economic applications of national power
- Determines what the adversary values most and how to affect it decisively.

Today's warfighting commanders receive joint intelligence that focuses almost entirely on military options to attack an enemy's warfighting potential. Alternatively, ONA offers a new, more extensive way to view an adversary; it broadens the scope of a commander's analysis to the totality of an adversary. ONA allows the United States and coalition partners to understand the systemic linkages that sustain an adversary's behavior and ability to continue the fight.

ONA fosters analysis of the adversary as a system of systems; understanding of key relationships, dependencies, and vulnerabilities; and identification of means to influence capabilities, perceptions, decision-making, and/or behavior.

Since the Department of Defense alone cannot generate the information required to support ONA development, national agencies and foreign governments will work together to develop ONA.

While the ONA process is integrated within the theater's Unified Command headquarters, it also takes advantage of an international network of "centers of excellence" by using its high-volume communications systems.

This network will give the theater commanders access to the full capabilities of the U.S. interagency community, as well as to nongovernmental and allied and coalition partners. All are significant partners who have information to contribute and engagement capabilities to consider.

From peacetime through conflict, ONA development is a continuous process:

- By increasing our understanding of a potential enemy and the conditions of our relationship with this party, ONA may contribute to achieving our national strategic and operational objectives.
- By using our full range of national capabilities, we avoid conflict by engaging a competitor or opponent in the influence-and-deter phases of the relationship.
- However, if influence-and-deter operations fail to achieve our national objectives, and conflict is imminent, then ONA describes a set of "defeat mechanisms" to accomplish our objectives rapidly and decisively, as well as to deny the enemy the ability to accomplish his.

Multinational Information Sharing

The multinational information sharing (MNIS) concept envisions the sharing of information in a single environment. Within this environment, information is protected at its source, and access control is based upon the participants' authorizations. Not all participants will have access to all information. Factors such as country and classification level may be used for controlling access. This environment will support the processing, storing, and transmission of releasable information from prehostilities through post-combat operational planning and execution.

Only participants of the multinational operation are allowed access within the multinational information-sharing environment, and access to selected information, based upon their credentials. The operational concept introduces a need for a Coalition Information-Sharing Policy and Procedures Panel (CISP3) as an integral part of a standing joint force headquarters component of any national military force. The CISP3 will not circumvent national disclosure policies of member nations but will serve as an arbiter of those policies. Its composition must include liaison officers working with the national military force, and it will help to develop, establish, and articulate the policy and procedures by which member nations will conduct operations.

System-of-Systems Analyses

The ONA frames our understanding of a potential adversary through political, military, economic, social, information, and infrastructure (PMESII) systems analyses. The systems analyses survey the adversary as a whole and then seek relationships within and among systems, as well as relevant details in each subsystem. Techniques such as link analysis, structured argumentation, and network analysis depict the adversary's systems. The systems analyses:

- Reveal critical nodes and vulnerabilities that can be used in effects-based operations
- Identify the relationships among important aspects of the adversary's social fabric
- Identify effects that will influence decision-making, will, and behavior
- Promote understanding of the adversary's goals, intentions, and perceived strengths and weaknesses
- Provide knowledge that can be used to predict second- and third-order and unintended *effects,* as a result of diplomatic, information, military, or economic applications of national power
- Determine how to affect efficiently and decisively what the adversary values most.

This type of analysis requires a thorough understanding of the adversary's culture, social influences, government, religion, and other intangible factors that are not available in traditional intelligence estimates. The analysis supports tangible understanding of the adversary, such as the location of traditional military targets, lines of communication, political organizational structure, and infrastructure targets. It also supports intangible

understanding of cultural influences, business relationships, historical influences, interpersonal relationships, and the flow of ideas and attitudes. The information necessary to develop this level of understanding is drawn from a wide variety of sources, including intelligence, academia, industry, and the public domain. The ONA development process begins before a crisis in order to establish the baseline of knowledge and understanding required in order to conduct actions.

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